"A COMPARATIVE STUDY IN EFFICACY OF ULTRASOUND GUIDED AUTOLOGOUS PLATELET RICH PLASMA AND CORTICOSTEROID INJECTION IN LATERAL EPICONDYLITIS"

Dissertation Submitted to

THE TAMILNADU DR.MGR MEDICAL UNIVERSITY, CHENNAI - 600032.

In partial fulfillment of the regulations for the Award of the Degree of

M.S. (ORTHOPAEDIC SURGERY)

BRANCH –II

GOVERNMENT KILPAUK MEDICAL COLLEGE

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MAY 2019

CERTIFICATE

This is to certify that the dissertation entitled **"A COMPARATIVE STUDY IN EFFICACY OF ULTRASOUND GUIDED AUTOLOGOUS PLATELET RICH PLASMA AND CORTICOSTEROID INJECTION IN LATERAL EPICONDYLITIS"** is a bonafide work done by **Dr. M. RAJADURAI, M.S ORTHOPAEDIC SURGERY BRANCH-II** at Government Kilpauk Medical College, Chennai-600010, to be submitted to The Tamil Nadu Dr. M.G.R Medical University, Chennai in partial fulfillment of the university rules and regulations for the award of M.S. Degree Branch-II Orthopaedic Surgery, under my supervision and guidance during the period from May 2016 to May 2019.

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DECLARATION

I solemnly declare that this dissertation **"A COMPARATIVE STUDY IN EFFICACY OF ULTRASOUND GUIDED AUTOLOGOUS PLATELET RICH PLASMA AND CORTICOSTEROID INJECTION IN LATERAL EPICONDYLITIS"** is a bonafide work done by me at Govt. Kilpauk Medical College and Hospital, Chennai-10 during the period from May 2016 to May 2019 under the guidance and supervision of my guide **Prof. Dr. M. Antony Vimal Raj, M.S.Ortho**, Professor of Orthopaedic Surgery, Govt. Kilpauk Medical College and Hospital, Chennai-10

This dissertation is submitted to **"THE TAMILNADU DR M.G.R MEDICAL UNIVERSITY",** Chennai in partial fulfillment of the University regulations for the award of degree of **M.S. BRANCH II ORTHOPAEDIC SURGERY.**

Place :

Date : **(Dr. M. RAJADURAI)**

INSTITUTIONAL ETHICS COMMITTEE
GOVT. KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Protocol ID. No. 12/2018 Meeting held on 08.01.2018

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A COMPARATIVE STUDY IN EFFICACY OF ULTRASOUND GUIDED AUTOLOGOUS PLATELET RICH PLASMA AND CORTICOSETEROID INJECTION IN LATERAL EPICONDYLITIS" submitted by Dr.M.RAJADURAI, Post graduate M.S.Ortho., Govt. Kilpauk Medical College, Chennai-10.

The Proposal is **APPROVED.**

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

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This is to certify that this dissertation work titled **“A COMPARATIVE STUDY IN EFFICACY OF ULTRASOUND GUIDED AUTOLOGOUS PLATELET RICH PLASMA AND CORTICOSTEROID INJECTION IN LATERAL EPICONDYLITIS”** of the candidate **Dr. M. RAJADURAI** with Registration number **221612155** for the award of **M.S** degree in the branch of **ORTHOPAEDIC SURGERY**. I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows **5 percentage** of plagiarism in this dissertation.

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Lastly, I thank all the patients who whole-heartedly consented for the study for the betterment of science without whom this study would not have been possible.

CONTENTS

INTRODUCTION

Over the past few years, Platelet Rich Plasma (PRP) has created a huge significance in several medical grounds, including orthopaedics. Numerous studies have shown that Platelet Rich Plasma can be used in the management of bony as well as soft tissue injuries. Lately, Platelet Rich Plasma has been used for chronic enthesopathies like tennis elbow, plantar fasciitis, in sports medicine and also in cartilage regeneration.

Platelet Rich Plasma is a portion of blood with platelets concentrated in plasma. The functioning of platelet rich plasma is mainly governed by the growth factors in the alpha-granules. TGF-BETA 1, PDGF, VEGF, EGF are the growth factors seen in platelet granules. Their main role lies on the healing process of many tissues. Platelet derived growth factor (PDGF) has mitogenic activity for both osteoblast as well as mesenchymal cells. PGF also has mitogenic potential which will regulate collagen production. VEGF-vascular endothelial growth factor, TGF-β transforming growth factor beta, FGF-fibroblast growth factor, CTGF-connective tissue growth factor, IGF-insulin like growth factor have analogous properties. It is because of the above growth factors, that Platelet Rich Plasma is a suitable substance for differentiation and regeneration of tissues.

The main uses of Platelet Rich Plasma-

- Acute ligamentous injuries
- Muscle injuries
- Chronic tendinopathies
- Also along with bone grafting

Tennis elbow (lateral epicondylitis) is a degenerative tendinopathy of extensor carpi radialis brevis muscle. It is commonly caused by repetitive micro trauma of the muscle due to overuse resulting in tendinosis of ECRB with or without involvement of extensor digitorum communis muscle.

With increased biological healing capacity, Platelet Rich Plasma helps in the cure of tennis elbow and also the relapse rate will be low. In our study, we used Ultrasound Guided Intralesional injection of autologous Platelet Rich Plasma and Corticosteroid injection for the treatment of chronic tennis elbow.

AIMS AND OBJECTIVES

To assess the efficacy of ultrasound guided autologous Platelet Rich Plasma and Corticosteroid injection.

To compare Autologous PRP (Platelet Rich Plasma) Vs Corticosteroid injection in terms of efficacy and its functional outcome.

TENNIS ELBOW

Tennis elbow is a condition, characterized by pain and tenderness over the lateral epicondyle of the humerus, and pain on resisted dorsiflexion of the wrist, middle finger or both. Tennis elbow (lateral epicondylitis) is a common orthopaedic condition in the 4th decade of life. The tissue usually fails to demonstrate inflammation, even though the term 'epicondylitis' means inflammation. About 40% to 50% of recreational tennis players will suffer this condition during their lifetime.[16,33] Although pain around the lateral epicondyle is commonly referred to as tennis elbow, tennis players make up only 10% of the patient population. Half of tennis players develop pain around the elbow, of which 75% represent true tennis elbow. The incidence is equal among men and women in the general population. The other names for this condition are lateral epicondylitis, peritenditis of the elbow, lateral elbow pain and tendonitis of the common extensor origin.

In most cases of lateral epicondylitis, no obvious underlying etiology can be identified. It starts as micro tear mainly in the origin of EXTENSOR CARPI RADIALIS BREVIS. The microscopic appearance is that of immature reparative tissue resembling angio-fibroblastic hyperplasia.

The tendon fibers attached to the periosteum over lateral epicondyle are relatively avascular and are subjected to ischemic stress and thus slow to heal. Many others did not find evidence of inflammation in chronic tennis elbow and it was suggested that the term epicondylosis should be used instead of epicondylitis.

PREDISPOSING FACTORS

- Conditions resulting in reduction of the carrying angle
- Weight lifting in supinated and extended forearm
- Sudden vigorous supination
- Work which uses repeated pronation and supination movement.[21]

Factors determining the chronicity of the lesion would be rheumatoid arthritis, gout and focal sepsis.[21]

Tennis elbow has an uncertain pathology.[40] As per one of the concepts, tendinosis mainly results due to the repeated wrist extensor muscle contraction which further leads to the microscopic tears. Local pathology consists of degeneration, disorganized collagen and neovascularity.

The exact cause of pain and degeneration in these patients is not clearly known but neural, vascular or healing failure has been proposed. Pain increases with resisted dorsiflexion of wrist and supination of forearm and there is pain on grasping objects.

According to **Robert E Bunata et al** conclusion, extensor carpi radialis brevis tendon has a distinct location, thereby making the area below it susceptible during the contact and abrasion against the capitellum during elbow movements.[40]

Knaushaar and Nirschi found that, surgical specimens obtained from failed treatment for tennis elbow by histology and electron microscopy had no evidence to suggest inflammatory process.

STAGES OF TENNIS ELBOW

- Early inflammatory reaction
- Angiofibroblastic degeneration
- Structural failure
- Fibrosis or calcification.[38]

Pathology:

- Non inflammatory, chronic degenerative changes of the origin of the EXTENSOR CARPI RADIALIS BREVIS muscle.
- ECRB muscle originates slightly medial and superior to the outer edge of capitellum on humerus, hence it is anatomically vulnerable to get compressed between EXTENSOR CARPI RADIALIS LONGUS and capitellum.
- The condition is caused by partial tearing of the tendon fibers at their attachments to the epicondyle and the epicondylar ridge and the constant muscle contractions thereby prevent healing.
- **NIRSCHL and PETTRONE** observed disorganization of normal collagen architecture by invading fibroblasts in association with an immature vascular reparative response, which is called ANGIOFIBROBLASTIC HYPERPLASIA.[5]

- Histology examination shows vascular proliferation and hyaline degeneration rather than inflammatory process.

- **ZEISIQ et al** found evidence of local, non-neuronal production of catecholamine in the fibroblasts, in the tissue at the muscle origin, and at the lateral epicondyles in patients with tennis elbow.[5]

- **BOSWORTH et al** demonstrated that the annular ligament undergoes hyaline degeneration and may be the source of pain. He reports tennis elbow cures by resection of the ligament, but in addition he severed or resutured the common tendon.[5]

Age Group:

35-54 years is the most common age group to be affected. Most commonly affected being the dominant arm.[17,33] Whenever there is increased work requiring resistance to wrist extension the patients commonly experiences burning or painful sensation over the lateral humeral epicondyle.[46]

COMMON PALPATION FINDINGS

- Decreased grip strength
- Tenderness at the lateral epicondyle
- Tenderness along the common extensor tendon.[46]

There are certain tests such as Cozen's test and Mill's maneuver that acts as efficient diagnostic tool generating pain by resisted extension of wrist.

Plain radiographs are normal. MRI shows tendon thickening with increased T1 and T2 signals. On an average, a typical episode of lateral epicondylosis lasts 6-24 months.

Waseem M et al explained that this condition is not an inflammatory process with no inflammatory cells (macrophages, lymphocytes, neutrophils) could be detected in the affected tissue. But, it is a form of tendinosis that affects the common extensor tendon with a fibroblastic and vascular response called angiofibroblastic degeneration of common extensor tendon.[53]

Ultrasound guidance of the injection will ensure precise targeting of tissue needle placement and real time visualization of needle during injection with documentation of changes in tendon morphology and structure after PRP injection.

CONSERVATIVE TREATMENT

- Non-steroidal anti-inflammatory drugs
- Ice application
- Braces
- Physiotherapy
- Rest.

Platelet rich plasma a bioactive component of whole blood, helps in regeneration of tissues with poor healing ability and being useful in varied

medical fields. For chronic tennis elbow patients, the study on platelet rich plasma versus autologous whole blood was done by **Christos Thanasas et al** and thereby supports the use of PRP in the management of tennis elbow.[9] **Mishra A et al** described positive results of platelet rich plasma injection in patients with tennis elbow.[32]

HISTORY OF PLATELET RICH PLASMA

Platelet rich plasma is also known as platelet rich growth factor, platelet rich fibrin matrix, platelets concentrate.

The concept and description of PRP started in the field of hematology. Hematologists created the term PRP in the 1970s in order to describe the plasma with a platelet count above of that of peripheral blood, which was initially used as a transfusion product to treat patients with thrombocytopenia.

Subsequently, PRP has been predominantly used in the musculoskeletal field in sports injuries. With its use in professional sports persons, it has attracted widespread attention in the media and has been extensively used in this field.

Other medical fields that also use PRP are cardiac surgery, pediatric surgery, gynaecology, urology, plastic surgery and ophthalmology.

More recently, the interest in the application of PRP in dermatology such as in tissue regeneration, wound healing, scar revision, skin rejuvenating effects, and alopecia.

Wounds have a proinflammatory biochemical environment that impairs healing in chronic ulcers. In addition, it is characterized by a high protease activity, which decrease the effect of growth factor concentration.

PRP is used as an interesting alternative treatment for recalcitrant wounds because it is a source of growth factors and consequently has mitogenic, angiogenic and chemotactic properties.

In cosmetic dermatology, a study performed in vitro demonstrated that PRP can stimulate human dermal fibroblasts proliferation and increase type 1 collagen synthesis. Additionally, based on histological evidence, PRP injected in human, in deep dermis and immediate sub dermis induces soft tissue augmentation, activation of fibroblast and collagen deposition, as well as new blood vessels and adipose tissue formation.

Another application of PRP is the improvement of burn scars, postsurgical scar and acne scars. According to the few articles available, PRP alone or in combination with other techniques seems to improve the quality of the skin and leads to an increased in collagen and elastic fibers.

In the 1980s, the advent of regenerative medicine aiming to rapidly translate the science into patient care using, the patient's own blood resources opened the door to use the platelets as vehicle for the delivery of a balanced pool of healing factors.

At the time, platelets were found to release wound healing substances that initiated the repair of injured tissues and vessels in cutaneous ulcers.

Later in the 1990s, platelets were introduced into maxillofacial surgery as autologous modifications of potent adhesives known as fibrin glue. A realization of the clinical potential of PRP therapies followed the positive clinical observations such as enhanced bone formation and anti-inflammatory functions during oral and maxillofacial surgeries (**Whiteman e**t al.[54], 1997; **Marx et al**[29]., 1998, **Anitua E et al**., 1999).

At the beginning of the millennium, PRP was used for the first time to treat the knee injuries in arthroscopic surgeries (Sanchez et al., 2003) and later it was extended to the treatment of tendons (Sanchez et al., 2007), muscle injuries (Sanchez et al., 2005), osteoarthritic knees (Schanz et al., 2008) and hips (Sanchez et al., 2011) and for use in chondropathies (Kon et al., 2010).

In 2006, PRP has started to be considered a potential therapeutic tool for promoting hair growth and tendon healing. Several studies have been published that refers to the positive effect PRP has an androgenic alopecia, wound healing and tendon healing.

PLATELET RICH PLASMA

Portion of the plasma fraction of autologous blood having a platelet value above baseline. Platelet rich plasma consists of full complement of clotting factors and secretory proteins along with the platelets.[45]

Bone marrow is the site of production of platelets from the megakaryocytes. Lifespan of a platelet cell is around 5-9 days.

Their direct contact with various extra-cellular proteins is established by the formation of platelet plug which is formed after tissue injury or surgery following platelet exposure to the damaged blood vessels.[45]

Normal platelet count – 150000/microliter and 350000/microliter, and average about 200000/microliter in blood.[29] **M Ferrari** (1987) was the first to promote platelet rich plasma as an autologous component after an open heart operation to avoid homologous blood product transfusion.[34]

Platelet Rich Plasma is an autologous product that concentrates a large number of platelets in a small volume of plasma. PRP functions as a fibrin tissue adhesive with hemostatic and tissue sealing properties, but it differs from fibrin glue and other platelet–poor tissue adhesive because its platelets provide a unique ability to promote wound healing and enhance osteogenesis.

PRP provides an immediate surgical hemostatic agent that is biocompatible, safe, and effective. PRP accelerates endothelial, epithelial, and epidermal regeneration, stimulates angiogenesis, enhances collagen synthesis, promotes soft tissue healing, decreases dermal scarring, and enhances the hemostatic response to injury.

The high leucocytes concentration of PRP has an added antimicrobial effect. Since PRP is an autologous blood product, it carries no risk of transmitting infectious disease.

Platelets are cytoplasmic fragments of megakaryocytes, formed in the bone marrow. They contain 30 bioactive proteins, many of which have a fundamental role in hemostasis or tissue healing. Few fundamental protein growth factors that are actively secreted by platelet initiate all wound healing process.

PRP also includes three proteins in blood known to act as cell adhesion molecules; Fibrin, Fibronectin, and Vitronectin.

Activation causes the granules present in platelets to fuse to its cell membrane where the secretory proteins are transformed to a bioactive state by the addition of histones and carbohydrate side chains.

The active proteins are then secreted, binding to transmembrane receptors of target cells, which includes mesenchymal stem cells, osteoblasts, fibroblasts, endothelial cells and epidermal cells. These agonists bound transmembrane receptors then activate an intracellular signal protein that causes the expression of a gene sequence that directs cellular proliferation, osteoid production, matrix formation and collagen synthesis.

CLASSIFICATION OF PRP:

According to the classification proposed by **Ehrenfest DM et al**. four main families of preparations can be defined, depending on their cell content and fibrin architecture.[15]

1. Pure Platelet Rich Plasma or Leucocyte-poor PRP products are preparations without leucocytes and with a low-density fibrin network after activation.

2. Leucocyte and PRP (L-PRP) products are preparations with leucocytes and with a low-density fibrin network after activation.

3. Pure Platelet Rich Plasma fibrin (P-PRF) or leucocytes-poor platelet rich fibrin preparations are without leucocytes and with a high-density fibrin network.

4. Leucocytes and platelet rich fibrin (L-PRF) or second generation PRP products are preparations with leucocytes and with a high-density fibrin network.

ROLE OF BIOACTIVE FACTORS:

Bioactive factors promote and accelerate the healing process and are stored and released by platelet alpha and dense granules.[7]

Alpha granules are reservoirs for numerous growth factors cytokines, chemokines and various coagulation and adhesive proteins.[7]

Growth factors released by alpha granules include vascular endothelial (VEGF), transforming beta (TGF-beta), platelet derived (PDGF), platelet derived epidermal (PDEGF), fibroblast derived growth factors and epidermal (EGF).[22]

Bioactive factors released by dense granules such as serotonin, histamine, calcium, adenosine diphosphate, adenosine triphosphate and dopamine. It is theorized that pain relief experienced by patients after PRP injection may result from the release of factors such as serotonin and catecholamine from dense granules.[7]

Platelet Biology

All blood cells derive from a common pluripotent stem cell, which differentiates into different cell lines. Platelets are nucleated, discoid cellular elements with different sizes. Platelet contain several secretory granules that are crucial to platelet function. There are 3 types of granules.

- dense granules
- o-granules
- lysosomes

In each platelet there are approximately 50-80 granules, the most abundant of the 3 types of granules. Platelets are primarily responsible for the aggregation process. The main function is to contribute to hemostasis through 3 processes; adhesion, activation and aggregation.

During a vascular lesion, platelets are activated and their granules release factor that promote coagulation. Studies suggest that platelets contain an abundance of growth factors and cytokines that can affect inflammation, angiogenesis, stem cell migrations, and cell proliferation.

Platelets release their contents and a cascade of event is initiated. Normal collagen is repaired. Collagen repair consists of the following phases; inflammation, proliferation and remodeling. Each of these stages is needed to restore the normal function of the tissue.

The presence of white blood cells in PRP may affect its use, independent of concentration of the platelets. Once platelets are activated, platelet aggregation occurs and the contents of their solid granules and alpha granules is released.

The activation of platelets in vivo is done in three ways; by adenosine diphosphate via membrane phospholipids system and inducing the presence of thrombin.

Functions of platelets:

Besides participation in hemostasis, platelets also have other functions. To obtain hemostasis, the interaction of three main mechanisms is necessary; vascular response, platelet activity and clot formation. The sub-endothelial Willebrand factor, are the main factor that activate blood platelets in vivo, as well as thrombin, adenosine diphosphate or a combination of them.

One of the essential factor for tissue healing is platelet.[22] The tissue healing begins with the platelet activation and clot formation.[22] The platelets act by means of various growth and differentiation factors.[22] They help in attracting mesenchymal stem cells, macrophages and osteoblasts which enhances tissue healing and regeneration and also helps in removal of necrotic tissue.

TGF-beta

1. regulates collagen synthesis

2. stimulates endothelial chemotaxis and angiogenesis

3. inhibits macrophage and lymphocyte proliferation.[22]

Platelet concentration related to tissue specific:

Different tissue types may require different platelet concentrations to achieve the optimal response to PRP administration. Receptor level vary between tissues, therefore ideal PRP concentrations may vary as well. This may explain why a specified concentration produces significant effects in one study with a specific tissue type and does not show an effect in another study involving a different tissue[1].

Anitua E et al, were able to demonstrate this when they studied the effects of 2 x and 4 x PRP on tendon, dermal and synovial fibroblasts. They demonstrated different positive effects for both platelet concentrations with respect to proliferation, hyaluronic acid production and secretion of angiogenic growth factors.[1] However, the positive effect was not consistently the same for each tissue type.

The authors concluded that the biological effects of preparations rich in growth factors may depend on concentration of platelets and on the anatomical source of the cells.

PRP activation by Cacl2

Calcium chloride added exogenously to PRP preparation in lieu of bovine thrombin may result in the formation of a less condensed fibrin matrix. The fibrin matrix may provide a trapping mechanism for platelets resulting in smaller amounts of thrombin formation endogenously, allowing a slower release of growth factors over a 7-day period which may enhance cell migration and healing.

Betoni Junior W et al, evaluated bone healing effects with the use of a bone graft with PRP combined with Cacl2, and thrombin compared with Cacl2 only.[6] After histological analysis, both methods presented good bone repair with similar maturity, organization and vascularization.

The results from this paper demonstrated that Cacl2 was an adequate activator of PRP when used alone, but thrombin also yielded a positive effect.[6]

GROWTH FACTOR FUNCTIONS RELATED TO PRP

GROWTH FACTORS	PRIMARY FUNCTIONS
Epidermal Growth Factor	Regulation of cell proliferation and survival
Insulin like Growth Factor	Key regulator of cell metabolism and growth stimulates proliferation and differentiation function in osteoblast
Platelet Derived Growth Factor	Major mitogen for connective tissue cells & Promotes the synthesis of collagen and structural proteins.
Transforming Growth Factor (alpha, beta)	Regulation of cell proliferation and differentiation and apoptosis and induction of intimal thickening.
Vascular Endothelial Growth Factor	Regulation of angiogenesis

FUNCTIONS OF PLATELET CONNECTIVE TISSUE GROWTH FACTOR:

- Promotes cartilage regeneration
- Promotes fibrosis
- Promotes angiogenesis.[22]

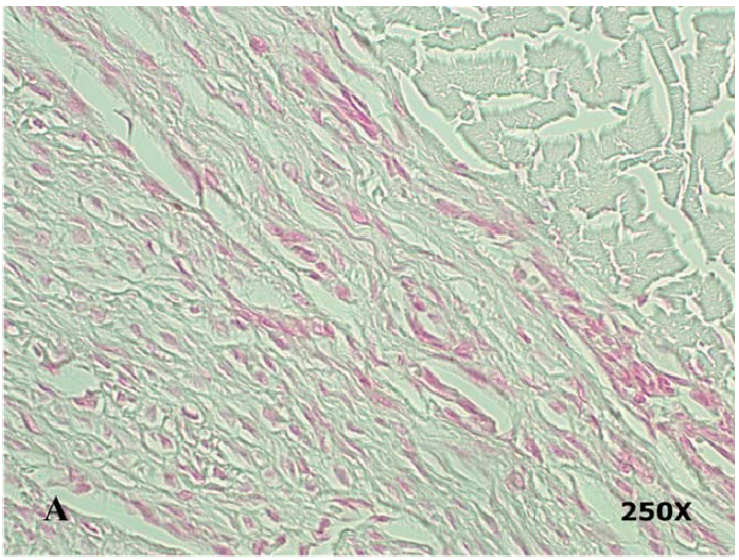
EFFECTS OF PRP IN DIFFERENT TISSUES

TENDON:

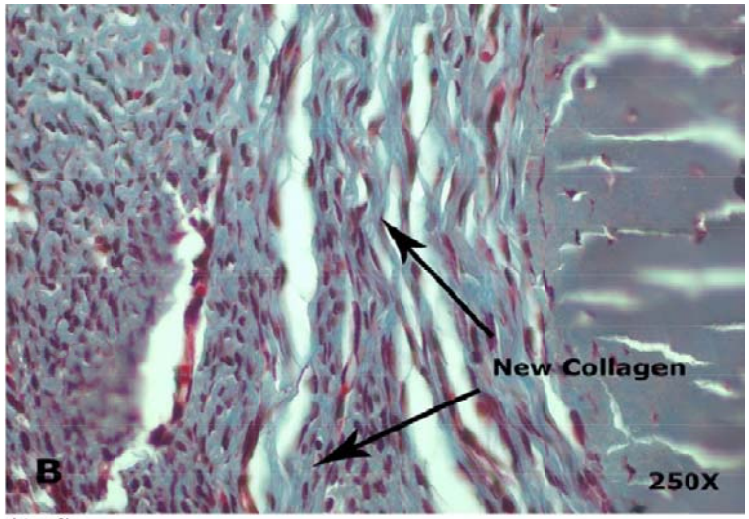
The use of PRP in tendon injuries and tendinitis was given **by Samir Mehtra** in his article.[45] This was also done by **Steven Sampson** in his article.[44] The effect of PRP on rabbit tendon was also stated by **N Lindsay Harris**.[35] Thick peritendon and cells of inflammation were observed at 2 weeks. Along with it, collagen bundles, vacuoles and inflammatory cells are also seen in the tendon tissue.

At 6 weeks, peritendon shows inflammation.

At 12 weeks, inflammation decreased.



NO CALCIFICATION
AT 2 WEEKS



picture 3b

COLLAGEN FORMATION
AT 2 WEEKS

Study on normal rabbit tissue was done **by N Lindsay Harris**[35] and found that at two weeks, there was thick tissue with inflammation and at 6 and 12 weeks there was minimal inflammation after PRP injection.

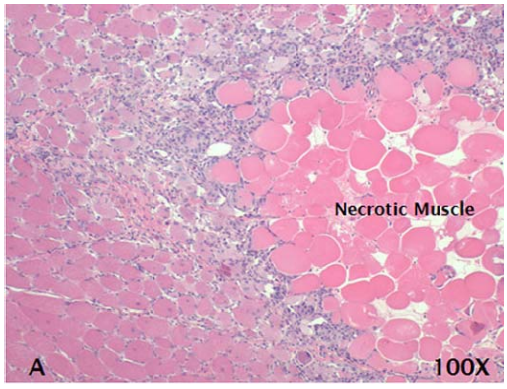
MUSCLE:

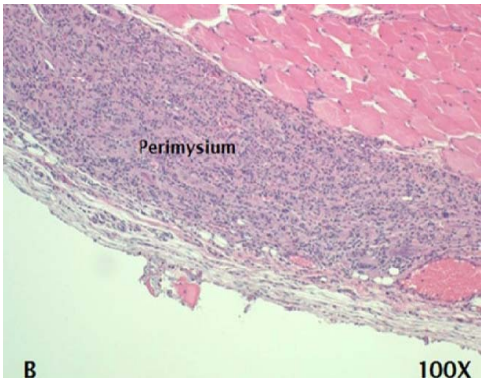
Kenneth S Lee[22] in his article stated about **Cugat et al** research on acute muscle injuries with PRP. The microscopic changes in normal muscle tissue following PRP injections was assessed on rabbit tissues by **N Lindsay Harris**.[35] The study was done on 18 rabbits by injecting 0.5ml of PRP into the tissues.

Features suggesting inflammation was found by him after two-weeks of platelet rich plasma injection. The inflammatory cells were observed in the tissue along with calcium deposition which was also seen.

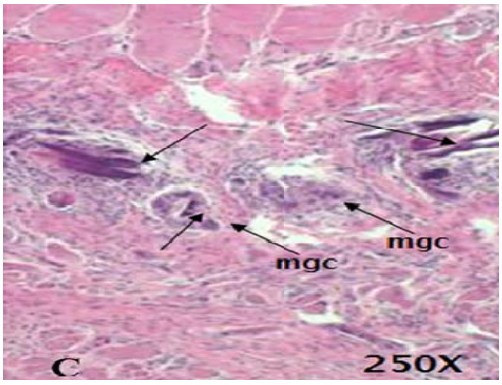
The inflammation stayed even after six weeks of injection. The inflammatory cells were seen. The calcium which was deposited was reabsorbed later.

After 12 weeks, no indications regarding inflammation were noticed.





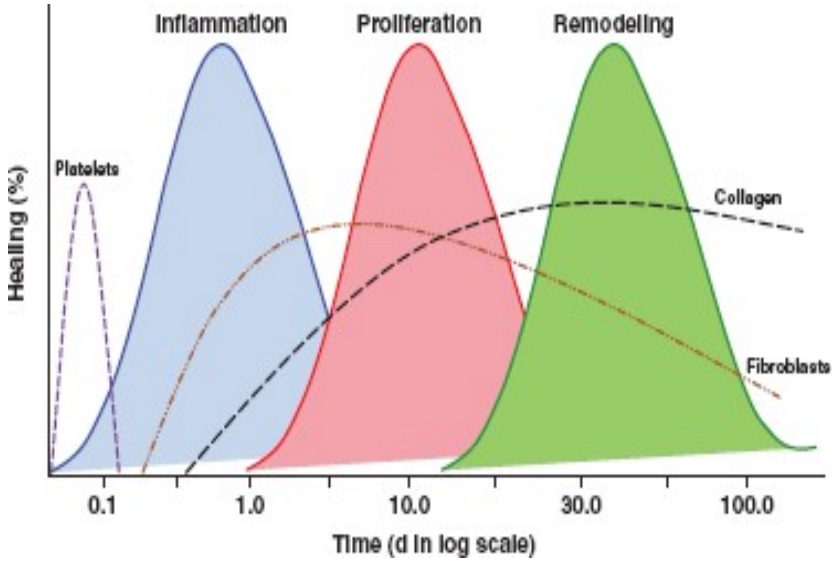
AT 2 WEEKS, INFLAMMATION CAN BE SEEN



AT 12 WEEKS, CALCIUM DEPOSITION SEEN (healing)

WOUND HEALING:

Platelet rich plasma ensures proper acceleration of the wound healing. Since there is increased amount of platelets in PRP, it helps in wound healing by release of growth factors. Several studies have been done by means of human trials and animal models thereby providing the information regarding the effect of PRP on wound healing.



PHASES OF WOUND HEALING AND THE TIME OF PLATELET ACTION

In his literature on platelet rich plasma, **Samir Mehtra** explained about the studies conducted by **Knighton D R et al**[26] and **C Gaino et al**. 17 out of 21 patients had re-epithelialization and 78 percent of patients had limb salvage in **Knighton D R et al** and **C Gaino** et al studies respectively. Platelet Rich Plasma has also got application in case of split skin graft as it can be used in the donor site. PRP reduces the crusting interval and also helps in accelerating the epithelialization.

In his literature on the effect of platelet rich plasma on musculoskeletal injuries, Steven Sampson has explained about the studies of **Crovetti et al** and **McAleer et al**. Twenty out of twenty four and nine out of twenty four had complete healing of the chronic ulcers in **McAleer etal** and **Crovetti et al** studies respectively.

BONE

The relationship between the effect of platelet rich plasma and bone healing has always been a topic of debate. Most of the studies had positive results, even though some of the animal studies not supporting PRP use.

When used along with bone grafts, growth factors like PDGF and TGF-beta can lead to bone healing. **Alsousou J et al**[4] did an article on the application of platelet rich plasma in orthopaedics, and in this there was statement about the study done by Bielecki et al and found that 13 out of 20 non unions, complete union was obtained after PRP application.

A study on assessment of the levels of growth factors in fracture hematoma in the same article above found that, no growth factors were found in nonunion. In the same article, a study of **Kitoh H et al** on distraction osteogenesis was explained and callus formation was observed at 34 to 47 days.[24]

The use of PRP in fractures in diabetic patients was also commented by **Alsousou J**. It was observed that growth factors were low in case of diabetic fracture callus. The healing process in the diabetic fractures can be accelerated once Platelet Rich Plasma is infiltrated.[4] In his article on platelet rich concentrate **Samir Mehtra** explained about the use of PRP in nonunion.[45]

He specified that platelet rich plasma can promote bone healing if adequate approximation of bone was present and not in gap nonunion.

JOINTS:

In his study on rabbit, **N Lindsay Harris** injected PRP into the normal tarsal joint with a control of normal saline injection. He observed features associated with synovitis in all with nodules in one specimen at two weeks.[35]

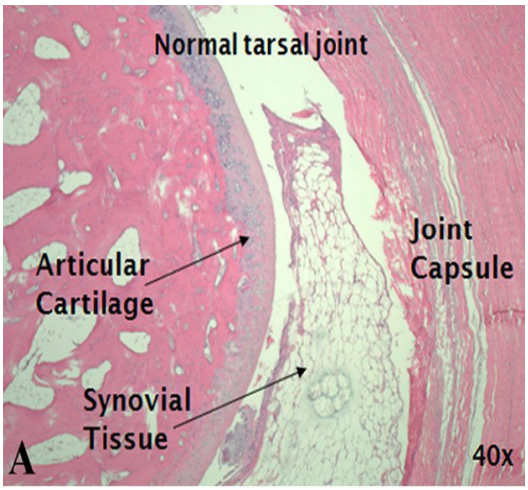


Fig A: SPECIMEN WITH NORMAL SALINE INJECTED

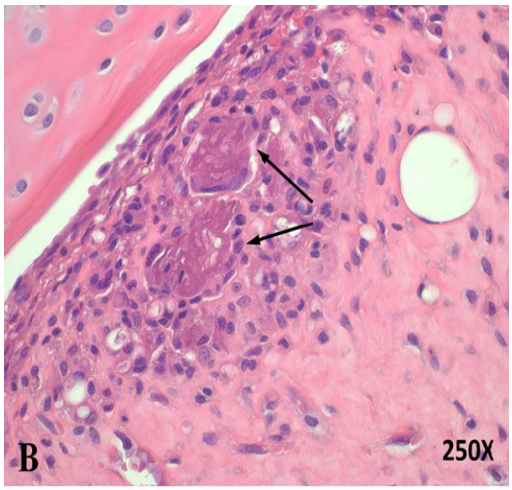


Fig B: SPECIMEN WITH PLATELET RICH PLASMA INJECTED

He also observed histological response similar to calcification in subcutaneous tissue at four weeks. At six weeks and twelve weeks all the specimens show normal findings as in normal saline specimen.[35]

THIS IMAGE SHOWS THICKENING OF COMMON EXTENSOR TENDON (7.64 mm)

- **HETEROGENOSITY (RED ARROW) MORE THAN 2/3rd OF TENDON**
- **OSTEOPHYTE FORMATION (PURPLE ARROW) AND CORTICAL IRREGULARITY OF LATERAL EPICONDYLE SURFACE**

PRP function related to fractures and delayed union or nonunion

PRP has demonstrated osteogenic properties in several invitro and preclinical studies, as shown in a review by **Iqbal et al.**[18] PRP was used in conjunction with other augments (bone graft, bone marrow concentrate) making it difficult to ascertain the relative contribution of platelet rich plasma. In a study of 30 patients with distal radius fractures, **Namazi H** and **Mehbudi** compared a single intraarticular injection of PRP immediately after percutaneous fixation.[36]

The PRP group reported better improvement in pain and activity scores compared with the control group at 3 and 6 months.

SAFETY OF PLATELET RICH PLASMA

The safety of autologous concentrate was given by **Samir Mehtra** in his article on platelet rich concentrate.[45] He explained that as it is prepared from the patient's own blood, the risk of communicable transmission is nil. In this he also stated that regarding the contraindications of platelet rich plasma in patients affected with coagulation disorders and hypersensitivity to the products like bovine thrombin.

Joost C Peerbooms et al in a study about tennis elbow with PRP observed that there was no local and systemic complications apart from increased pain during the first few days after PRP injection due to the inflammatory process.[20]

Bielecki et al in a study to find the antibacterial effect of autologous PRP against methicillin sensitive staphylococcus aureus and supports the growth of Pseudomonas aeruginosa.[8]

PLATELET RICH PLASMA PREPARATION:

Regarding the preparation of PRP, there are 2 techniques:

Open technique

The product is exposed to the environment of the working area and comes in contact with different materials that should be used for their production, such as pipettes or product collection tubes. In the blood processing to obtain PRP with the open technique, it should be guaranteed that the product is not contaminated during microbiological handling.

Closed technique

It involves the use of commercial devices with centrifuge equipment marking in which the product is not exposed to the environment. Several centrifuge equipment devices are available for the production of autologous PRP. Most of them are included in one of the following 3 types of devices.

1. The blood is obtained with a tube that contains an anticoagulant, and this tube can be used for any type of centrifuge.

2. Medical devices with which the blood is collected into a tube that already contain an anticoagulant.

3. Medical devices with which the blood filled is collected into a syringe previously filled with an anticoagulant; usually, the blood is transferred into a secondary device whose shape imposes the use of the centrifuge supplied by the same manufacturer. The preparation of PRP depends on the type of device chosen and should be done according to the manufacturer's instructions.

Different studies used various methods for preparing PRP. 15 ml of patient own venous blood was withdrawn from antecubital vein under aseptic conditions and was collected in presterilized centrifuged four vacutainers vials. These centrifuge vials were preloaded with anticoagulant Acid Citrate Dextrose. These four vacutainers were subjected to a first spin in a centrifuge at a speed of 2500 rpm for 10 minutes.

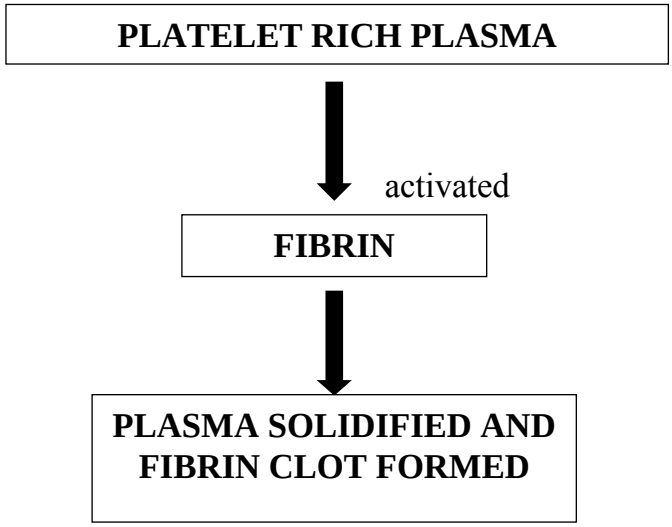
After the first spin three layers appear,

- The deep layers consist of RED BLOOD CELLS
- The middle layers consist of PLATELETS AND LEUCOCYTES.
- The top layers consist of PLATELET POOR PLASMA

The top and middle layers were transferred to a fresh vacutainer. The plasma was then subjected to a second spin at a speed of 3500 rpm for 15 minutes. The plasma at the bottom which is rich in platelets was separated and used for infiltration. The resulting platelets concentrate contains 6-8 times the concentration of platelets compared to baseline whole blood.

PRP ACTIVATION

Platelet rich plasma results in increased release of growth factors with 90% released in 10 minutes. PRP can be stimulated by calcium chloride and thrombin exogenously and by mechanical trauma endogenously. Most growth factors have short half life.



The enmeshment of growth factors and cells is stimulated by a more stable tetra molecular network initiated by a physiological manner.

Accidental stimulation can happen by injuring cells and also by braking systems of the centrifuge machines. To prevent this, while drawing blood large bore needles should always be used.

PRP, which is obtained at a higher concentration than full blood, is an encouraging treatment option. Biologically active proteins expressed by active platelets lead to gene expression by binding to the transmembrane receptors in the target cells. As a result, cellular recruitment, growth and morphogenesis are triggered and at the time, inflammation is reduced.

PRP system that use the buffy coat contain an increased concentration of WBCs. Although normal level of WBC has a positive immunomodulatory effect, heightened levels in some PRP preparations may have deleterious effects.

Platelet-rich leucocytes gel is thought to have potent antimicrobial effects. PRP containing WBCs may help prevent post-operative staphylococcus aureus infections. Other potential benefits of WBCs include removal of necrotic tissue through cellular engulfment of tissue by products, the release of proteolytic enzymes that breakdown necrotic tissue or release additional growth factors that may play a supplementary role in eliminating dead tissue.[39,50]

Negative Effects of WBCs in PRP

Specific WBCs, such as neutrophils and $CD8^+$ lymphocytes, may be detrimental to PRP therapy. Neutrophils are not crucial to the overall process of wound healing and collagen synthesis. Infiltration of neutrophils causes release of oxygen free radicals during inflammation and has been shown to play a central role in ischemic tissue injuries.

This may cause endothelial and subendothelial damage and lead to excessive fibrosis that can exacerbate a pre-existing injury and prevent healing. White blood cells also release catabolic cytokines, matrix metalloproteinase and interleukin-beta.

These substances are regulators of inflammation and degradative turnover of tissue.

Neutrophils also exacerbate muscle damage after an injury. It has been suggested that WBCs are detrimental in fracture healing by suppression of bone formation and bone healing. A study was performed to determine the effects of polymorphonuclear leucocytes in fracture healing.

Role of platelets in Healing

The healing process can be divided into 3 phases;

Phase1 (hemostasis and inflammation) is triggered by tissue injury and lasts for 2-5 days.

During phase 1, platelets become activated when they encounter injured tissue and adhere to the exposed collagen, aggregating to form a clot.[11] Degranulation of platelets occurs and the release of growth, bioactive, and hemostatic factor results in inflammation.

Platelets release 70-95% of the stored growth factors in the first 10 minutes after tissue injury and additional growth factors continue to be secreted for 7-9 days.[7,12]

Phase2 (proliferation) begins 2 days after injury and can last for 3 weeks.

These phase involves formation of blood vessels, collagen deposition via fibroblasts, wound contraction and continued release of small amounts of growth factors.[7]

Phase3 (remodeling) follows and involves maturation of collagen and formation of scar tissue and can take more than a year to complete.[7,8]

Plasma based PRP

Plasma based methods work to isolate only plasma and platelets components. Protocols for these preparations leave some platelets behind and focus on intentionally excluding leucocytes, which are thought to be detrimental to the healing process.

Buffy coat based PRP

Buffy coat based methods isolate a platelet poor plasma layer and a buffy coat layer, which contains both leucocytes and erythrocytes. Differences in concentration of platelets, and the presence or absence of white blood cells leads to different amounts of anabolic and catabolic proteins released to the target tissues after injection.

Invitro study performed by **Castillo et** al tested three different PRP separations system, each system yielded similar platelet concentration, red blood cells, active TGF-beta and fibrogen levels.[10]

A recent innovation of PRP, which is a component of blood in which the platelets are concentrated in a limited volume of plasma. Autologous platelet gel was first developed as a byproduct of multicomponent pheresis. The platelet count in PRP can exceed 2 million platelets per micro liter. A natural blood clot contains 95% red blood cells, 5% platelets, less than 1% white blood cells.

It can be considered that PRP jump starts the cascade of regenerative events leading to the formation of a mature graft site. The PRP obtained offers up to a 2.16 times increase in maturation rate and substantially greater density of a bone graft procedure.

Components of PRP

1. Growth factors
2. WBC and phagocytic cells
3. Native fibrogen concentration
4. Vasoactive and chemotactic agents
5. High concentration of platelets.

Role of growth factor in PRP

PRP is an autologous source of concentrated suspension of the growth factors found in platelets. Activated PRP release growth factors and enhance wound healing and wound strength.

Growth factors derived from platelets initiate connective tissue healing, bone regeneration and repair, promote development of new blood vessels, and stimulates the wound healing process.

Platelet derived growth factor (PDGF)

PDGF is a very powerful regulatory growth factor and a sentinel growth factor that begins nearly in all wound healing. PDGF main function is to stimulate cell replication (mitogenesis) of healing capable stems and premitotic partially differentiated osteoprogenitor cells, which are part of the connective tissue-bone healing cellular make up.

PDGF also causes replication of endothelial cells, causing budding of new capillaries (angiogenesis).

PDGF exists in three forms:

PDGF-AA

PDGF-BB

PDGF-AB

All isoforms of PDGF are released after adhesion of platelets to an injured site. The AA and BB isoforms enhance proliferation of bone cells, increasing the production of PDGF-AA in osteoblasts cultures.

Transforming Growth Factors: (TGF)

TGF regulates proliferation and differentiation of multiple cell types. TGF found in platelets is subdivided into TGF-beta1, TGF-beta 2, which are more generic connective tissue growing factors involved with matrix formation influencing osteoblasts to lay down bone matrix through the process of

ostegenesis. A chondroprogenitor cells will further differentiate and produce the matrix for cartilage. A mesenchymal stem cell stimulated to mitosis provides wound healing cells.

In vitro, TGF-beta has been observed to promote extracellular matrix production in many cell types, such as tendon healing fibroblasts. TGF-beta 1 used alone or in combination with PDGF-BB, stimulates the proliferative activity of tendon healing.

Insulin Growth Factor (IGF)

IGF is also important in tendon healing, and stimulates both proliferation and differentiated function in osteoblasts. IGF has two forms 1 and 2 each of which has 2 single chain peptides. IGF1 stimulates bone formation by proliferation and differentiation, and it is synthesized and secreted by osteoblast. Human patients treated with a combination of 150mg/dl each of recombinant human platelet derived growth factor-BB.

Epidermal Growth Factor (EGF)

EGF is responsible for cell differentiation and stimulates re-epitheliation, angiogenesis and collagenase activity. Vascular endothelial growth factor (VEGF) have potent angiogenic, mitogenic and vascular permeability enhancing activities specific for endothelial cells.

The short shelf life and inefficient delivery to target cells are major concerns associated with local administration of recombinant human growth factors. The growth factors are expensive, and many doses may be required to achieve any therapeutic effect.

Major Benefits of PRP

PRP starts osteogenesis by releasing growth factors at the local site. Osteoblasts are then moved across a greater distance by creating a scaffold system that will assist their movement.

Early consolidation of the graft

The increased amount of PDGF in the graft initiates osteocompetant cell activity at an enhanced molecular site.

Speed up mineralization

Because mineralization on a graft site is a coupled phenomenon, osteogenesis must proceed in such a way that activation and bone formation is greater than resorption. Mineralization of the collagen matrix is speeded up due to PDGF being added right from the start in the mineralized bone segment of the graft, instead of being released from collagen. Use of PRP has shown to improve the rate of bone formation by 1.62 to 2.18 times that of the controls.

Improves trabecular bone density

There has been reported in the literature that a 15% to 30% improvement in trabecular bone density when platelet rich plasma factor is added to the graft.

The native fibrinogen concentration imparts a gelatinous adhesive consistency, for ease of surgical application and results in reduction of pain and infection.

Sequence of bone Regeneration

Platelets are responsible for initiation of regeneration of tissue from trauma. During repair, platelets become entrapped in a fibrin clot and degranulate releasing two primary growth factors; PDGF and TGF-beta. PDGF binds to endothelial cells to initiate capillary ingrowth and TGF-beta binds to osteoblasts and stem cells to initiate mitosis and stimulate osteoid production.

The life span of platelets in a wound is less than five days. Macrophages are attracted into the graft through an oxygen gradient of 30-40 mm Hg and drive the remaining bone regeneration process.

By day 14, complete revascularization of the graft is seen. Stem cells differentiated into osteoblasts and osteoid is being laid down. Early bone formation occurs, by four to six weeks, random cellular bone called woven bone, is formed which is immature and disorganized.

In phase 2 remodeling lamellar bone is formed, representing a more organized bone.

Stefano Gumina et al, used autologous thrombin for platelet activation.[49] **Juan Ramon Valenti Nin et** al, used 10% Cacl2 for activation of platelets intra operatively. That the force necessary for inducing rupture during tensile test was more for tendons which had a PRP injection than the control group.[19]

HUMAN STUDIES IN PLATELET RICH PLASMA

1. **Taco Gosens et** al done a study on patients suffering from chronic tennis elbow.[51] Two treatment methods were used. Both platelet rich plasma and corticosteroid injections were used for the treatment. 100 patients were included in that study. Out of these 100 patients a computer based system allocated the patients into two groups. First group had 51 patients and second group had 49 patients. First group of patients were injected with platelet rich plasma and the second group was injected with steroid. VAS and DASH scoring system were used both before and after the injection for the evaluation of patient's condition. Two years from the time of injection was the follow-up period. It was found that patients treated with PRP showed good improvement in their condition than those patients treated with steroid injection. Therefore, they concluded that platelet rich plasma had good effect in treating tennis elbow.

2. **Mishra A et** al done a study in order to find the effect of using buffered platelet rich plasma on chronic severe elbow tendinitis.[32] In this study, 140 patients suffering from epicondylar elbow pain were included. All patients were dealt with physical therapy being a standardized protocol and other nonoperative treatments. For all patients, surgery was considered.

This cohort of patients who had failed conservative treatment was then given either a single platelet rich plasma or bupivacaine injection. It was observed that 8 weeks after the injection, the PRP group noted 60% improvement in their VAP scores and 16% improved in the control group. After the 8th week, 60% (3 of 5) of the control subjects withdraw or sought various treatments, preventing further direct analysis. At 6 months, 81% improvement in visual analog pain scores were observed in patients who got PRP treatment. During the final follow-up at 12-38 months, 93% reduction in pain was observed in the PRP patients compared with the before treatment.

3. **Ehab Mohamed SelemRagab et** al done a study in order to observe the effectiveness of PRP treatment in case of chronic plantar fasciitis.[14] The population of patient they selected was 25 and they injected the 25 patients with PRP. VAS and USG thickness of the fascia were used for the assessment. They followed up for 10 months. They observed that, with the use of visual analog pain scale, the average pre-injection pain in patients was 9.1 (range 8-10). Prior to injection, 72% patients suffered from severe limitation of activities and 28% of patients had only moderate

limitation of activities. It was also observed that the average post-injection pain decreased to 1.6.

Twenty-two patients (88%) were fully satisfied, two patients (8%) were satisfied with reservations, and one patient (4%) was unsatisfied with using the visual analog scale.[14]

4. **Suzan de Jonge et** al done a study in order to find the use of PRP in treating tendinopathy. They opted Achilles tendinopathy for their study. The criteria by which this study was done was tendinopathy at 2-7cm from insertion of tendon. They selected 44 patients for their study.

USG was used for assessment during pre-injection and post-injection period and one scoring system was used. VISA was the scoring system that was used. A control group was selected to whom only saline injection was given. Patients of both the groups suffered from tendinopathy and both group underwent severe exercises. After the study period, they assessed the results and observed that the patients in both the group improved, by means of scoring system and by USG evidence. 59% of patients improved in both the groups and they cannot make any difference in the groups.[43]

5. **Leon Creaney et** al in a study linked the effect of PRP with autologous blood injection in elbow tendinopathy.[27] 150 tennis elbow patients were selected and 80 patients were treated with PRP and the remaining 70 patients were treated with whole blood.

They evaluated the patients by using PRTEE score. The authors observed a 66% success at 6 months.

6. **Stefano Gumina et** al done a study to assess the clinical and Magnetic Resonance Imaging (MRI) results of arthroscopic repair of rotator cuff both with and without the use of platelet-leukocyte membrane in patients with a large posterior-superior rotator cuff tear, observed that rotator cuff re-tears were found only in the group of patients in whom the membrane had not been used, and a thin but intact tendon was observed more frequently in this group.[49] 80 full thickness tear of rotator cuff patients were used and all the patients who underwent arthroscopic repair and randomly used platelet rich membrane for the treatment. Outcomes were the difference between the preoperative and postoperative constant scores and the integrity of repair was assessed by MRI as per the Sugaya classification. Another outcome they used was preoperative and postoperative Simple Shoulder Test Scores. The results portrayed that only significant differences between the two groups involved the patient age and the preoperative and postoperative constant scores; the differences in the constant score were due to differences in the shoulder pain subscore.

MATERIALS AND METHODS

This is a prospective trial involving the patients in the Department of Orthopaedics, Government Kilpauk Medical College and Hospital from April 2017 to April 2018. Approval was obtained from Ethics Committee for Research in human beings before this study.

A total of 220 patients were included in this study. Out of this, 110 patients were injected with PRP and rest 110 patients were given corticosteroid injection. All the patients were selected based on the inclusion and exclusion criteria described. Patient were selected by random methods on lot basis.

All patients were treated as Out Patient. All the patients underwent same method of treatment. All the patients were assessed based on the numerical pain scoring system which will be described. Among the study group 71% of Dominant hand involvement is found.

INCLUSION CRITERIA

1. Pain more than 3 months after failed conservative treatment
2. Patients should have pain score more than eight at the time of PRP and corticosteroid injection.
3. Patients should not had a local steroid injection in last 2months
4. Both male and female
5. Age- 18 years and above
6. Pain and tenderness over the lateral aspect of elbow

One of the test must be positive : 1. COZEN'S TEST

2. MILL'S MANEUVER

1. COZEN'S TEST: Ask the patient to make a firm fist. While the patient maintains this position, try to passively flex the wrist. Patient will feel pain at the lateral epicondylar region.

2. MILL'S MANEUVER: While the patient keeps his/her elbow firmly straight and wrist flexed, pronation of the forearm initiates pain at the lateral epicondylar region.

EXCLUSION CRITERIA

- Less than 3 months duration
- Pain score less than eight
- Patients with diabetes mellitus
- Infection at the injection site
- Thrombocytopenia
- Patient on anti-platelet medications
- Pregnancy
- Patients younger than 18years

Side effects after Corticosteroid injection

1. Local hypopigmentation noted in 20% of cases
2. No Allergic reactions in any of the cases

Side effect was reported in one case after PRP injection.

On evaluation it was diagnosed to be biopsy proven tuberculous synovitis of elbow. He was started on Anti tuberculosis treatment. Subsequently patient recovered well.

INFORMED CONSENT

After explaining the disease condition and treatment with PRP and Corticosteroid injection in their native language, informed consent was acquired from all the patients. All the patients agreed for the procedure and to participate in the study. The consent form was signed by all the patients and their nearest relative.

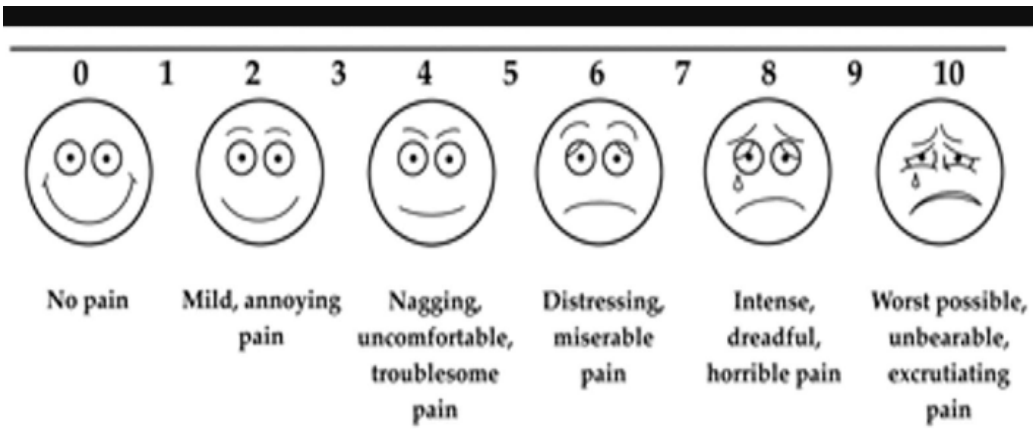
CLINICAL DIAGNOSIS

Diagnosis of tennis elbow was done when the patient experienced pain along the lateral aspect of the elbow joint. On dorsiflexion of wrist, this pain would worsen. On examination, localized tenderness was elicited over the lateral epicondyle of the patient.

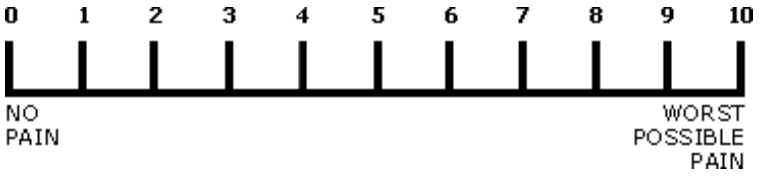
NUMERICAL PAIN SCORE

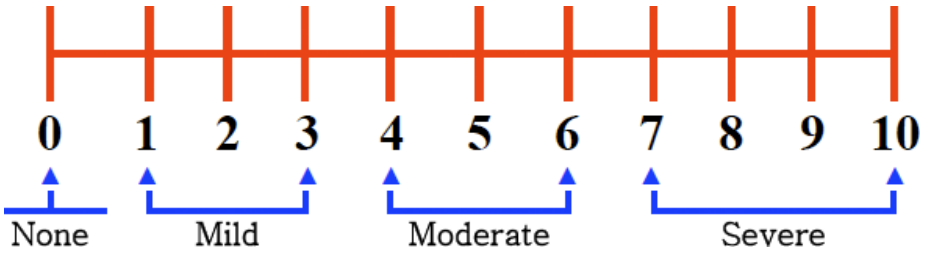
Numerical pain score is used as a subjective evaluation of pain. In this, the patient is asked to rate the intensity of the pain perceived by them. Score zero (0) means there is no pain. Score 10 refers to the worst pain possible.

As per the Numerical pain score, pain intensity was categorized as mild, moderate and severe.



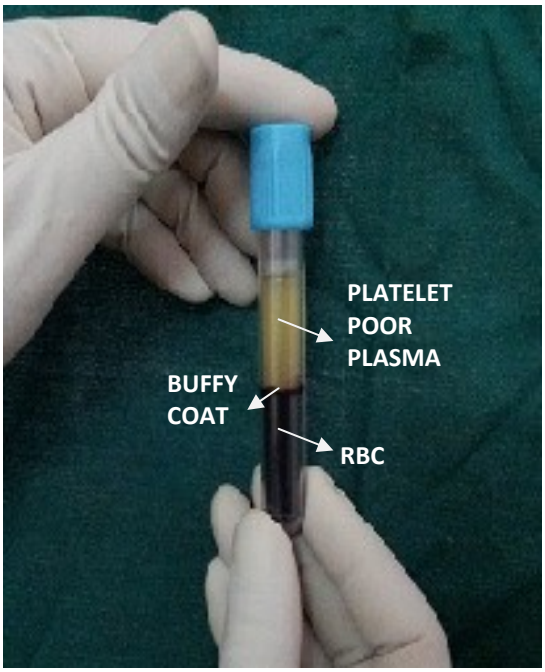
- Score 0 to 3 -- MILD
- Score 4 to 6 -- MODERATE
- Score 7 to 10 -- SEVERE





PREPARATION OF PRP

Platelet Rich Plasma was prepared using double spin centrifugation method. 15ml of patients own venous blood was withdrawn from antecubital vein under aseptic conditions and was collected in pre sterilized centrifuge four vacutainers vials. These centrifuge vials were preloaded with anticoagulant Acid Citrate Dextrose. This vacutainer was subjected to a first spin in a centrifuge at a speed of 2500 rpm for 10 minutes. After the first spin three layers appear.



- The top layers consist of PLATELET POOR PLASMA (It contains approximately 2,70,000 platelet cells / cu.mm)
- The middle layers consist of PLATELETS AND LEUCOCYTES (It contains approximately 3,90,000 platelet cells / cu.mm)
- The deep layers consist of RED BLOOD CELLS (It contains approximately 1,25,000 platelet cells / cu.mm)

The top and middle layers were transferred to a fresh vacutainer. The plasma was then subjected to a second spin at a speed of 3500 rpm for 15 minutes. The plasma at the bottom which is rich in platelets was separated and used for infiltration. The resulting platelets concentrate contains 6-8 times the concentration of platelets compared to baseline whole blood.

- The top most layer of second spin consist of PLATELET POOR PLASMA (It contains approximately 43,000 platelet cells / cu.mm)
- The bottom layer of second spin consist of PLATELET RICH PLASMA (It contains approximately 10,25,000 platelet cells / cu.mm)

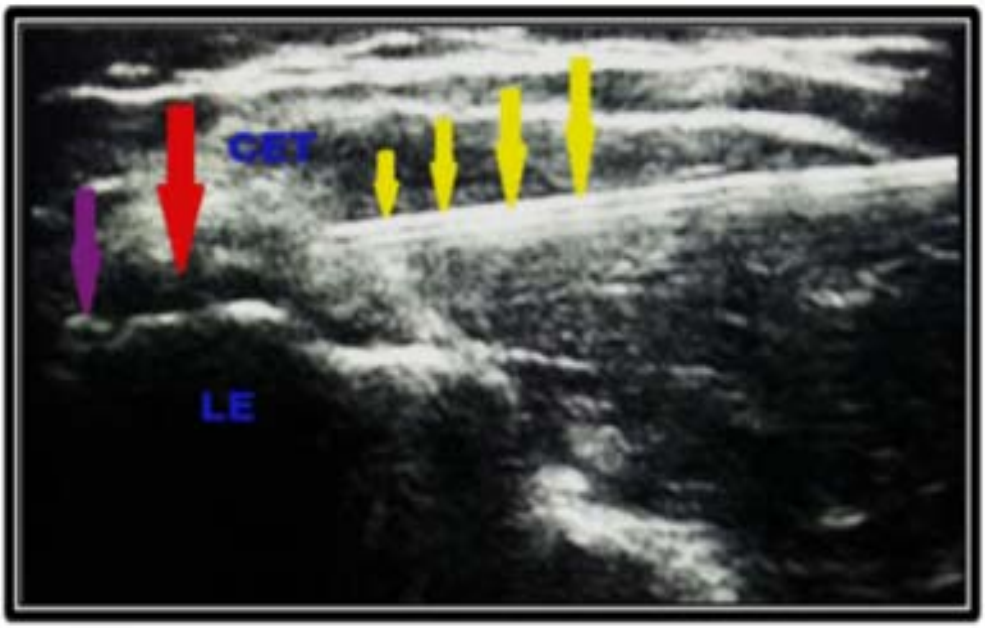
THE CENTRIFUGE USED FOR PRP PREPARATION

TECHNIQUE OF INFILTRATION

The most tender point was palpated under ultrasound guidance and the point is marked using a skin marker and the site was prepared for injection. Under aseptic condition, using a 21G and 1 1/2 inch needle, 1ml PRP is injected initially over the site with maximum tenderness and the needle is partially withdrawn and multiple punctures are made in the surrounding tissue (peppering technique). The surrounding tissue was injected with the remaining 1ml of platelet rich plasma.

DURING INJECTION

ULTRASOUND IMAGE OF PRP INJECTION



YELLOW ARROW indicates 21G needle

RED ARROW indicates heterogenous hypoechoic area

PURPLEARROW indicates osteophytes

PLATELET ACTIVATION

As per **Kenneth S Lee** et al, needling of surrounding tissue will promote the activation of the platelets by means of release of thrombin from the fresh bleeding. This technique is used for platelet activation.[22]

FOLLOW UP

Patients were followed up for 6 months. Follow up was done at second day after injection to find out any adverse reactions. All cases were protected with brace initially and given oral antibiotics for 1 weeks with cold fomentation, and then restoration with normal daily activities were allowed from the third week with stretching and physiotherapy. NSAIDS are contraindicated 1 week before and after the procedure. Opioid analgesics can be given. Follow-up was done at 1, 2, 4, 6 months. Patients were assessed subjectively using the numerical pain score.

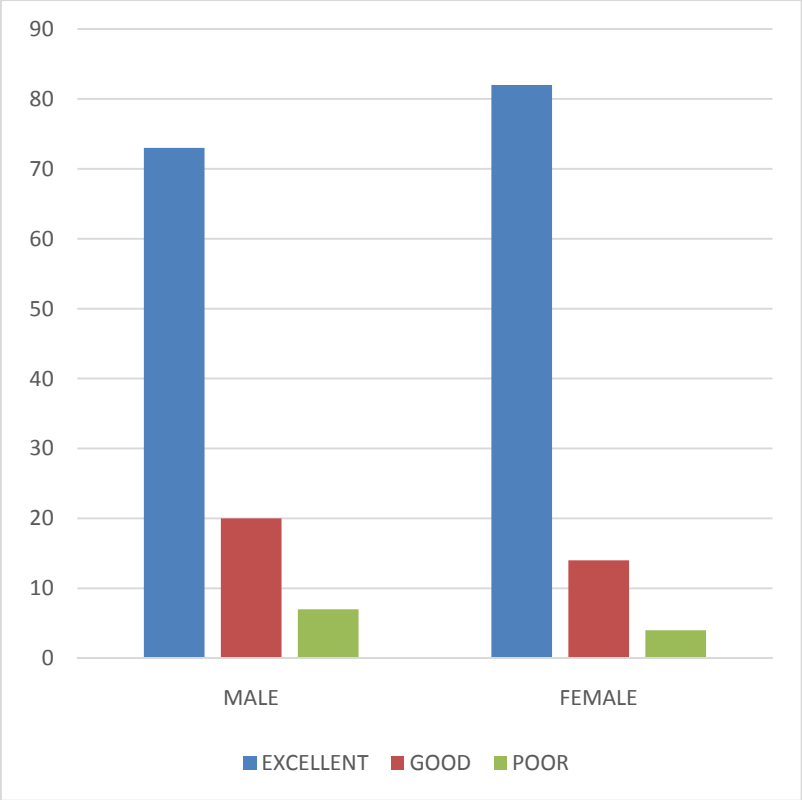
RESULTS AND ANALYSIS

Patients were analyzed for pain relief subjectively at 1, 2, 4 and 6 months. The results are given below.

PERCENTAGE REDUCTION OF PAIN

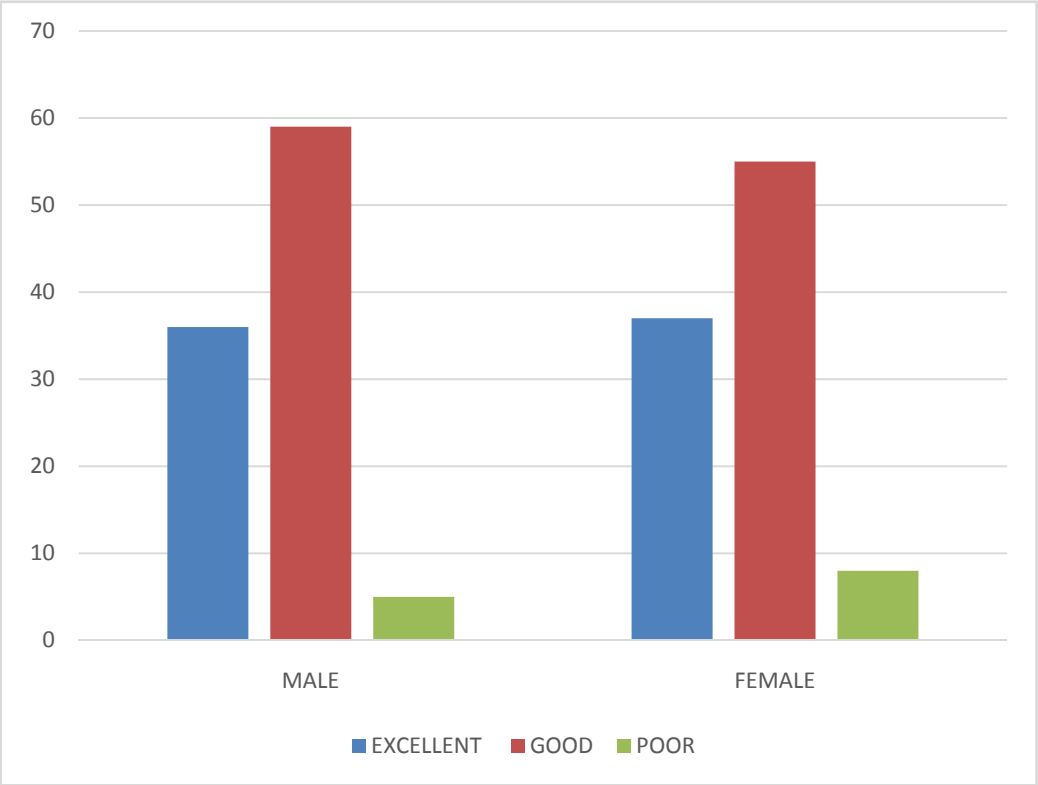
Patients were analyzed for percentage reduction of pain. Percentage reduction of pain is obtained by calculating the percentage of the difference of pain score at every follow-up from initial pain score at the time of injection.

PERCENTAGE REDUCTION OF PAIN IN PRP PATIENTS



GENDER	EXCELLENT	GOOD	POOR
MALE	73%	20%	7%
FEMALE	82%	14%	4%

PERCENTAGE OF PAIN REDUCTION IN CORTICOSTEROID GROUP



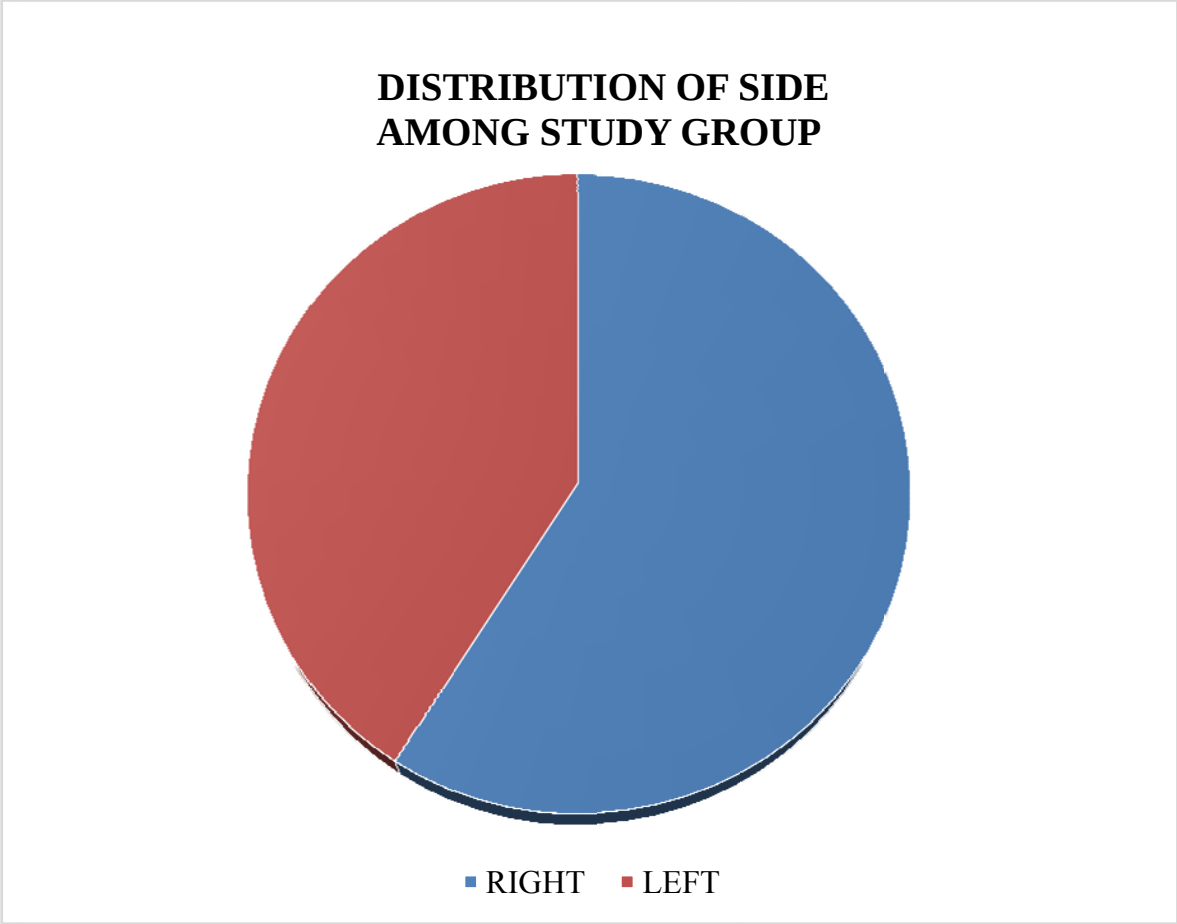
GENDER	EXCELLENT	GOOD	POOR
MALE	36%	59%	5%
FEMALE	37%	55%	8%

First month recoded					
GROUP			**Frequency**	**Percent**	**Valid Percent**
PRP	Valid	0% pain relief	4	3.5	3.5
		1-49%	81	72.6	72.6
		50-99%	17	15.9	15.9
		100%	8	8.0	8.0
		Total	110	100.0	100.0
CORTICOSTEROIDS	Valid	0% pain relief	6	4.7	4.7
		1-49%	86	79.4	79.4
		50-99%	12	10.3	10.3
		100%	6	5.6	5.6
		Total	110	100.0	100.0

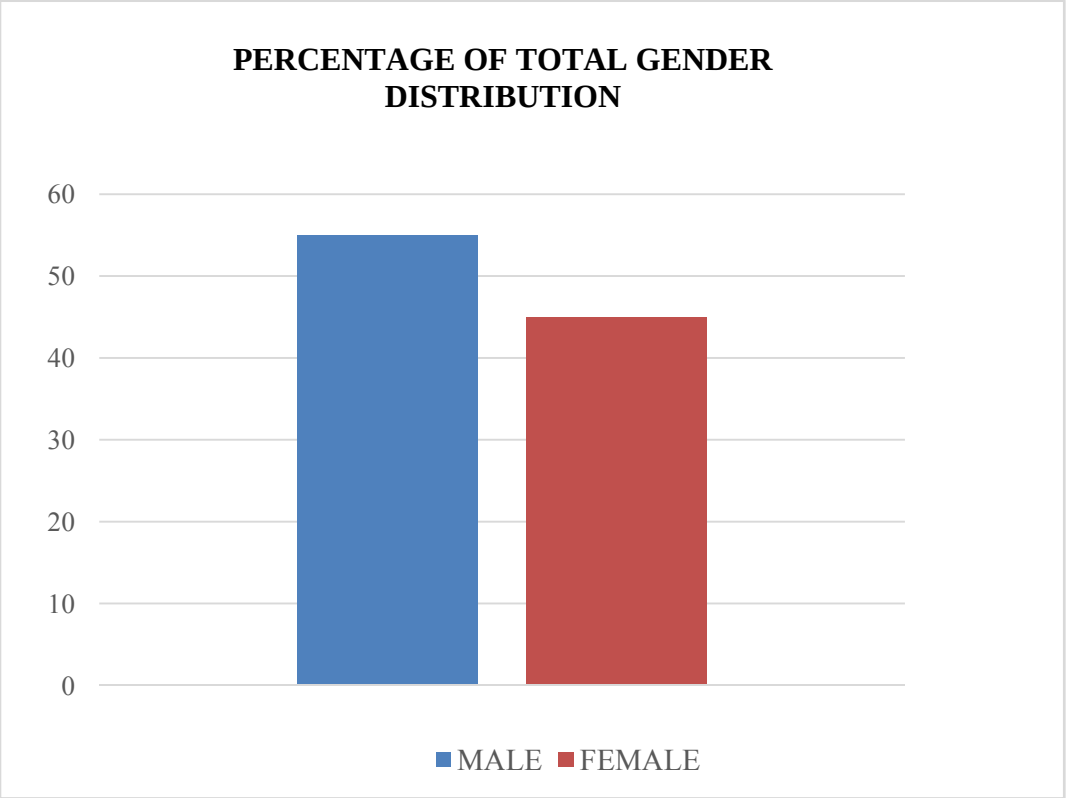
Second month recoded					
GROUP			**Frequency**	**Percent**	**Valid Percent**
PRP	Valid	0% pain relief	4	3.5	3.5
		1-49%	63	56.6	56.6
		50-99%	26	23.9	23.9
		100%	17	15.9	15.9
		Total	110	100.0	100.0
CORTICOSTEROIDS	Valid	0% pain relief	5	3.7	3.7
		1-49%	78	72.0	72.0
		50-99%	15	13.1	13.1
		100%	12	11.2	11.2
		Total	110	100.0	100.0

Fourth month recoded					
GROUP			**Frequency**	**Percent**	**Valid Percent**
PRP	Valid	0% pain relief	4	3.5	3.5
		1-49%	8	8.0	8.0
		50-99%	80	71.7	71.7
		100%	18	16.8	16.8
		Total	110	100.0	100.0
CORTICOSTEROIDS	Valid	0% pain relief	5	3.7	3.7
		1-49%	40	36.4	36.4
		50-99%	51	47.7	47.7
		100%	14	12.1	12.1
		Total	110	100.0	100.0

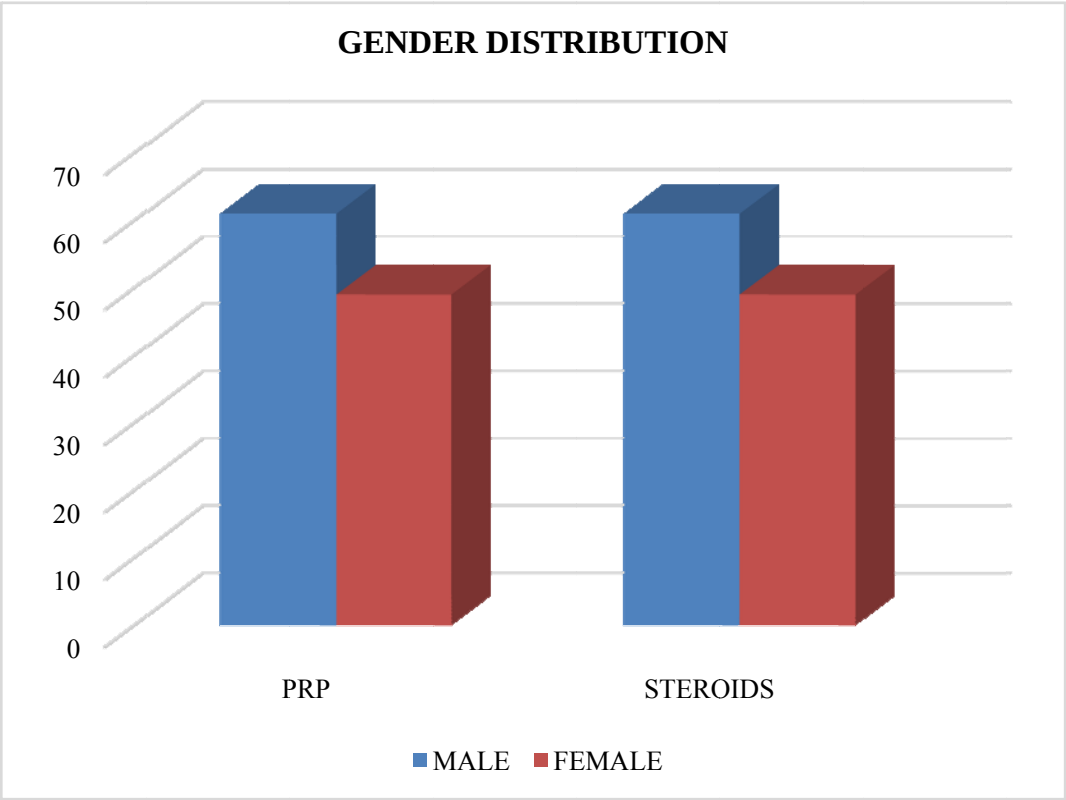
Sixth month recoded					
GROUP			**Frequency**	**Percent**	**Valid Percent**
PRP	Valid	0% pain relief	4	3.5	3.5
		1-49%	5	4.4	4.4
		50-99%	84	76.1	76.1
		100%	17	15.9	15.9
		Total	110	100.0	100.0
CORTICOSTEROIDS	Valid	0% pain relief	4	3.7	3.7
		1-49%	28	25.2	25.2
		50-99%	65	59.8	59.8
		100%	13	11.2	11.2
		Total	110	100.0	100.0



DISTRIBUTION OF SIDE AMONG STUDY GROUP	
RIGHT SIDE	59%
LEFT SIDE	41%



PERCENTAGE OF TOTAL GENDER DISTRIBUTION	
MALE	55%
FEMALE	45%



	MALE	FEMALE
PRP	61%	49%
CORTICOSTEROIDS	61%	49%

STATISTICAL ANALYSIS

T-TEST:

Group Statistics					
	GROUP	N	Mean	Std. Deviation	Std. Error Mean
AT INJECTON	PRP	110	8.7788	.41693	.03922
	CORTICOSTEROIDS	110	8.8785	.32824	.03173
First month	PRP	110	5.7965	2.37607	.22352
	CORTICOSTEROIDS	110	6.3084	2.22935	.21552
Second month	PRP	110	4.2035	2.26053	.21265
	CORTICOSTEROIDS	110	4.9065	2.15675	.20850
Fourth month	PRP	110	2.8673	1.80032	.16936
	CORTICOSTEROIDS	110	4.0561	1.93201	.18677
Sixth month	PRP	110	2.2212	1.75120	.16474
	CORTICOSTEROIDS	110	3.8318	1.90573	.18423

Independent Samples Test				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
AT INJECTON	Equal variances assumed	.051	-.09974	.05078
	Equal variances not assumed	.049	-.09974	.05045
First month	Equal variances assumed	.101	-.51195	.31104
	Equal variances not assumed	.101	-.51195	.31050
Second month	Equal variances assumed	.019	-.70300	.29820
	Equal variances not assumed	.019	-.70300	.29781
Fourth month	Equal variances assumed	.000	-1.18882	.25164
	Equal variances not assumed	.000	-1.18882	.25213
Sixth month	Equal variances assumed	.000	-1.61054	.24658
	Equal variances not assumed	.000	-1.61054	.24715

Our study was significant as the P value is <0.05

DISCUSSION

Protease inhibitor, adhesive proteins, coagulation factors are the biologically active substances present in platelet for clotting. Platelets also release TGF –beta 1, VEGF, PDGF, CGF. These help in the process of tissue healing by cellular differentiation and proliferation, angiogenesis, tissue debris removal, chemotaxis, and ECM formation.[47] By direct local injection of autologous platelet rich concentrate, degenerative conditions like tennis elbow are treated.

Multiple methods are being used for the preparation of autologous Platelet Rich Plasma. The containers used for this preparation differs to minimize the direct blood-handling. The volume of Platelet Rich Plasma is usually 10 percent of the whole blood used. **Alsousou J et al** used a GPS system for preparation of PRP. The PRP volume of about 5 ml was collected following 12 minutes of rotations at 3200 rpm.[4] **Augustus D et** al used a double centrifugation method which separates blood first into plasma and RBC.[3]

The Plasma formed was separated again in to Platelet Rich Plasma and platelet poor plasma by second centrifugation. In this study, **Augustus D et** al method of double centrifugation was used.[3] By repeated trial and error method we standardized the procedure of preparation of platelet rich plasma.

Platelet rich concentrate, autologous platelet gel are synonyms for platelet rich plasma.[45] Platelet rich plasma is defined as autologous blood with

a concentration of platelets above the base line values. The platelet counts in our samples ranged from two to six lakhs per cc. Hall M.P. et al described platelet rich plasma contains a two to eight fold increase in platelet concentration and 1-25 fold increase in growth factor concentration. According to **Marx R E et** al in an article "what is prp and what is not prp?" described that at least 10 lakhs of platelet per ml in five ml of plasma, will be associated with enhancement of healing.[29] **Alsousou J et** al in a review article described a concentration of five times the normal count as working definition of PRP.[4]

ELISA can be used for measurement of concentration of the growth factors. **Augustus D et al** found that growth factors such as PDGF, IGF-1 will be increased in single centrifugation than in double centrifugation.[3] Measurement of growth factors are not done because their assay was not cost effective.

Depending on WBC concentration, PRP classified as low WBC PRP and high WBC PRP. Augustus D et al found that WBC count is reduced in platelet poor plasma and increased in platelet rich plasma.[3] There were no significant difference in WBC cell types in platelet poor plasma and platelet rich plasma.[3] Some authors suggested avoiding exposure of WBC to tissues so that inflammatory reaction may reduce.

Bielecki T M et al support the WBC presence as it increased release of growth factors and also has antibacterial actions.[8]

After release from circulation, platelets in PRP get activated.

Kenneth S Lee et al described that needle prick at the time of injection will induce bleeding which will provide the clotting factor thrombin needed for activating platelets. Addition of substances like bovine thrombin, calcium chloride and type 1 collagen for activating platelets.[22]

Most of the authors used similar technique of infiltration for PRP treatment. Keith s Hetchman et al, Joost C Peerbooms et al, Ertugrul Aksahin et al, Ehab Mohamed SelemRagab et al, used similar technique. They palpated the point of maximum tenderness and injected by single skin portal and five to six penetrations in surrounding tissues. This technique was known as peppering technique.

In our study, we used same technique for injecting platelet rich plasma in Tennis elbow patients. This was a prospective trial by study design conducted on 220 patients which includes 110 patients injected with PRP and 110 patients injected with corticosteroid injection.

Both groups of patients were selected based on the inclusion criteria and exclusion criteria described. Patients having chronic inflammatory conditions like rheumatoid arthritis are excluded from the study. Assessment of progression was done based on numerical pain scoring system.

Christos Thanases et al compared PRP to whole blood in the treatment for tennis elbow.[9] **Keith S Hetchman et** al on 31 tennis elbow patients which was not responded for conservative treatment by single PRP injection.[23]

TWO PARALLEL STUDIES (PRP VS CORTICOSTEROID)

Samuel A Taylor et al on 100 tennis elbow patients compared between PRP and steroid injection.[46]

V V Reddy et al on 150 tennis elbow patients compared between PRP and corticosteroid. Both VAS and DASH score shows improvement in pain relief noted in PRP group compared than CORTICOSTEROID group at 26th and 52 weeks follow up.[52]

On linking the results at 1,2,4,6 months of follow up, it was established that patients got relieved of their pain in one month. But, only at two months there was noticeable relief of symptoms. No patients had repeat injections. The above results were comparable with **Ertugrul Aksahin et al** and **Christos Thanases et al** study.

The difference between 1, 2, 4 and 6 months pain reduction were tested for significance by paired T – test using SPS system. It was found that there was no notable difference in pain reduction between 2 months and 4 months, 2 months and 6 months, 4 months and 6 months scores.

But there was major difference in pain score in 1 and 2 months. By testing independent samples T-test using equal variances assumed found that 2 months, 4 months and 6 months pain reduction was considerably equal in all groups.

LIMITATIONS OF OUR STUDY

1. A subjective evaluation was done based on patient's insight of pain (VAS score) and the evaluation was not based on objective point of view (in the form of hand grip strength).

2. Control group was used and therefore available for evaluation in this study.

3. The concentration of platelets in PRP was not checked and standardized.

SUMMARY

Lateral epicondylitis is considered to be a degenerative tendinopathy, with recurrent micro trauma as the major cause. Autologous platelet rich plasma injections and corticosteroid injections are gaining popularity in the treatment of tendinopathies such as tennis elbow. Platelet rich plasma contains growth factors which help in healing of tissues. We conducted a study by intralesional autologous platelet rich plasma injections and corticosteroid injections in patients with tennis elbow.

This was a prospective study conducted on total 220 patients, out of this 110 patients had autologous platelet rich plasma injection and 110 patients had corticosteroid injection for tennis elbow.

Patients were analyzed for percentage reduction of pain. Percentage reduction of pain is obtained by calculating the percentage of the difference of pain score at every follow up from initial pain score at the time of injection. Out of 220 patients, 110 patients given PRP and 110 patients CORTICOSTEROIDS.

Based on inclusion and exclusion criteria patients were designated. Patients were given a single intralesional autologous PRP and corticosteroid injections by peppering technique. Platelet rich plasma was prepared by a double centrifugation method initially at 2500 rotations per minute for 10 minutes and later at 3500 rotations per minute for 15 minutes.

15ml of blood was withdrawn out of which 2ml of PRP was attained. Cell count was analyzed from this PRP. The initial and 1 & 2, 4, 6 month's numerical pain score was recorded and analyzed.

In PRP group, 61 patients were male and 49 patients were female. Among male patients, based on VAS and DASH score 73% had excellent prognosis, 20% had good prognosis and 7% had poor prognosis. Among female patients, 82% had excellent prognosis, 14% had good prognosis and 4 % had poor prognosis.

In CORTICOSTEROID group, 61 patients were male and 49 patients were female. Among male patients, based on VAS and DASH score 36% had excellent prognosis, 59% had good prognosis and 5% had poor prognosis. Among female patients, 37% had excellent prognosis, 55% had good prognosis and 8 % had poor prognosis.

In PRP group, among 58% of patients with right dominant side involvement, 40 % of patients returned to their normal routine labourer work without any pain, rest 18 % people started office works.

No correlation was found in the period of symptoms to pain relief which were assessed. On conclusion, it was found that intralesional autologous platelet rich plasma injection was safe and useful in the treatment of tennis elbow and provided better benefits on long term basis as compared to corticosteroid injection.

In our study, maximum benefit was observed at 2 months. One patient developed pain and swelling of right elbow after 2 months of PRP injection. On evaluation it was diagnosed to be biopsy proven tuberculous synovitis of elbow. He was started on Anti tuberculosis treatment. Subsequently patient recovered well.

CONCLUSION

Autologous PRP and CORTICOSTEROID injection is a safe and useful modality of treatment in the treatment of lateral epicondylitis.

The response of patients with PRP was significantly better than CORTICOSTEROID injection in the treatment of lateral epicondylitis.

Maximum benefit after PRP injection was observed at 2 months and sustained for at least 6 months.

Corticosteroids are effective on short term basis only. But PRP is effective on long term basis.

Also, we encourage more randomized clinical trials on this topic emphasizing on the number and frequency of injections as well as standardization of concentration of platelets in PRP to overcome limitations.

In our study, we found Autologous PRP is found to be superior than corticosteroid.

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CONSENT FORM

Study detail: ***"A Comparative Study in Efficacy of Autologous Platelet richplasma and Corticosteroid injection in Lateral Epicondylitis"***

Study Centre :Govt. Kilpauk Medical College & Hospital, Chennai.

Patients Name :

Patients Age :

Identification No :

Patient may check (/) these boxes

I confirm that I have understood the purpose of procedure for the above study. I had the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ☐

I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ☐

I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ☐

I hereby make known that I have fully understood the use of above surgical procedure, the possible complications arising out of its use and the same was clearly explained to me and also understand that this technique is a new method of treatment of patella fractures and this study is done to know the usefulness of the same in management of patella fractures ☐

I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well-being or any unexpected or unusual symptoms. ☐

I hereby consent to participate in this study. ☐

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests. ☐

Signature/thumb impression:

Patients Name and Address: Place : Date :

Signature of investigator

A COMPARATIVE STUDY IN EFFICACY OF ULTRASOUND GUIDED AUTOLOGOUS PLATELET RICH PLASMA AND CORTICOSTEROID INJECTION IN LATERAL EPICONDYLITIS"

Investigator : Dr.M.Rajadurai

PATIENT DETAILS:

Name :

Age :

Sex :

Hospital Number :

Disease :

Duration of Symptoms :

Pain Score :

Date of Injection :

Follow Ups

1st Month	2nd Month	4th Month	6th Month

MASTER CHART

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
1	VIJAYA	43	F	PRP	7 MONTHS	9	0	0	0	0
2	PALANI	40	M	CORTICOSTEROID	6 MONTHS	8	4	3	3	3
3	SUBASH	43	M	CORTICOSTEROID	4 MONTHS	9	8	8	8	8
4	SUSEELA	56	F	PRP	5 MONTHS	9	0	0	0	0
5	SELVI	37	F	PRP	6 MONTHS	8	2	0	0	0
6	SAKTHI	48	F	PRP	3 MONTHS	9	4	3	3	3
7	JANAKI	39	F	CORTICOSTEROID	1 YEAR	9	6	4	4	4
8	VALLI	55	F	PRP	3 MONTHS	9	0	0	0	0
9	BHARAT	38	M	PRP	5 MONTHS	8	8	8	8	8
10	RAMAN	38	M	PRP	1 YEAR	9	6	0	0	0
11	MARIYAN	48	M	CORTICOSTEROID	8 MONTHS	8	8	8	8	8
12	SUMAN	36	M	CORTICOSTEROID	1 ½ YEAR	8	6	2	0	0
13	GANESH	60	M	PRP	6 MONTHS	9	0	0	0	0
14	GOKUL	54	M	PRP	3 MONTHS	8	6	4	4	6
15	VIJI	55	M	CORTICOSTEROID	1 YEAR	9	0	0	0	0
16	SENBAGAM	36	F	CORTICOSTEROID	1 YEAR	9	2	0	2	8
17	SELVAM	49	M	PRP	1 YEAR	8	8	8	8	8
18	UMA	39	F	PRP	3 MONTHS	9	2	0	0	0
19	MAHESH	36	M	PRP	1 YEAR	8	8	8	8	8
20	PANDIYAN	38	M	CORTICOSTEROID	1 ½ YEAR	8	2	0	0	0
21	PADMINI	59	F	CORTICOSTEROID	8 MONTHS	9	1	0	0	0
22	RAJA	45	M	PPR	3 MONTHS	8	0	0	0	0
23	KALIYAN	55	M	CORTICOSTEROID	3 MONTHS	9	0	0	0	0
24	MANJU	28	F	CORTICOSTEROID	6 MONTHS	9	2	0	0	0
25	VENKAT	38	M	PRP	5 MONTHS	8	0	0	0	0

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
26	ANNIE	58	F	CORTICOSTEROID	1 YEARS	9	7	5	5	6
27	DHANAM	49	F	PRP	3 MONTHS	8	6	4	4	4
28	SENTHIL	31	M	CORTICOSTEROID	3 MONTHS	9	0	8	6	6
29	SAVITHA	49	F	PRP	1 ½ YEARS	8	3	0	0	0
30	RAVICHANDRAN	40	M	PRP	1 YEAR	8	6	3	3	3
31	THIRUPATHI	51	M	CORTICOSTEROID	8 MONTHS	8	6	4	4	4
32	GOVIND	50	M	CORTICOSTEROID	6 MONTHS	9	9	0	0	0
33	LALITHA	48	F	PRP	5 MONTHS	9	8	6	5	5
34	LAKSHMI	47	F	PRP	4 MONTHS	9	3	2	2	2
35	THANGAM	50	M	PRP	6 MONTHS	9	0	0	0	0
36	PARASURAMA N	49	M	CORTICOSTEROID	3 MONTHS	9	0	0	0	0
37	DARANI	27	M	PRP	8 MONTHS	9	8	6	4	2
38	MYTHILI	31	F	CORTICOSTEROID	6 MONTHS	9	0	0	0	2
39	SHANGAVI	46	F	CORTICOSTEROID	3 MONTHS	9	6	6	6	6
40	DEVAN	49	M	CORTICOSTEROID	4 MONTHS	9	2	1	0	0
41	NARAYAN	54	M	PRP	6 MONTHS	9	0	0	0	0
42	MOORTHY	69	M	PRP	8 MONTHS	9	0	0	0	0
43	PREM	49	M	PRP	1 YEAR	9	9	9	9	9
44	POOJA	48	F	CORTICOSTEROID	1 ½ YEARS	9	9	9	9	9
45	VENKATESAN	59	M	PRP	1 ½ YEARS	9	2	0	0	0
46	SARASU	30	F	PRP	8 MONTHS	8	6	4	4	4
47	RANIYAMMAL	48	F	CORTICOSTEROID	3 MONTHS	9	9	9	9	9
48	SIGARAM	39	M	CORTICOSTEROID	6 MONTHS	9	0	0	0	0

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
49	KAVI	34	M	PRP	8 MONTHS	8	4	1	1	1
50	RUKKU	43	F	CORTICOSTEROID	1 ½ YEARS	9	9	9	9	9
51	USHA	56	F	PRP	6 MONTHS	9	7	3	2	2
52	PADMA	54	F	PRP	1 ½ YEARS	9	7	7	7	7
53	SAVARIMUTHU	49	M	PRP	8 MONTHS	9	5	2	0	0
54	MARIAPPAN	63	M	PRP	5 MONTHS	8	3	0	0	0
55	MUTHU	54	M	CORTICOSTEROID	6 MONTHS	8	4	4	4	4
56	ANITHA	40	F	PRP	3 MONTHS	9	4	0	0	0
57	JAYAM	64	F	PRP	8 MONTHS	8	3	3	3	3
58	BHUVANESH	32	M	PRP	9 MONTHS	8	4	0	0	5
59	SAROJA	69	F	PRP	6 MONTHS	9	3	3	3	3
60	PARVEEN	40	M	CORTICOSTEROID	9 MONTHS	8	2	0	0	0
61	GOKUL	40	M	PRP	3 MONTHS	8	3	2	2	2
62	SUNDAR	30	M	CORTICOSTEROID	6 MONTHS	8	4	4	4	4
63	KALA	30	F	CORTICOSTEROID	5 MONTHS	9	7	3	3	3
64	MANOJ	40	M	PRP	8 MONTHS	8	2	2	2	2
65	PALANI	50	M	PRP	1 ½ YEARS	9	2	0	0	0
66	VIJAYA	50	F	CORTICOSTEROID	1 YEAR	8	4	0	0	0
67	KUTTI	60	F	PRP	2 YEARS	8	3	3	3	3
68	VIJAY	57	M	PRP	8 MONTHS	9	4	3	3	3
69	VARUN	40	M	PRP	9 MONTHS	9	7	3	2	2
70	SEELA	59	F	CORTICOSTEROID	3 MONTHS	9	3	3	3	3
71	RANI	45	F	PRP	7 MONTHS	9	5	5	3	3

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
72.	KANNAN	50	M	PRP	9 MONTHS	9	6	4	4	4
73	KARUPPAN	43	M	CORTICOSTEROID	9 MONTHS	9	5	3	3	3
74	ANITHA	32	F	CORTICOSTEROID	8 MONTHS	9	6	5	4	4
75	SUBA	34	F	CORTICOSTEROID	9 MONTHS	9	8	5	5	4
76	RAJA	42	M	PRP	6 MONTHS	8	6	4	2	2
77	KUMAR	33	M	CORTICOSTEROID	8 MONTHS	9	8	5	4	4
78	PRABHU	45	M	PRP	1 YEAR	9	6	3	2	2
79	SAKTHI	35	F	PRP	9 MONTHS	9	5	4	4	4
80	KUPPUSAMY	38	M	CORTICOSTEROID	8 MONTHS	9	7	5	4	4
81	RAJAN	56	M	CORTICOSTEROID	7 MONTHS	8	6	6	5	5
82	VIJAY	47	M	CORTICOSTEROID	8 MONTHS	9	6	5	4	4
83	DURAI	45	M	CORTICOSTEROID	10 MONTHS	9	6	4	4	3
84	KAVITHA	46	F	PRP	9 MONTHS	9	4	4	3	3
85	KAVIYA	55	F	PRP	9 MONTHS	9	6	3	3	2
86	KANNIYAMMAL	43	F	CORTICOSTEROID	8 MONTHS	9	7	6	6	6
87	ARPUTHAM	60	F	CORTICOSTEROID	6 MONTHS	8	6	6	5	4
88	TAMIL	43	F	PRP	7 MONTHS	9	6	4	3	3
89	KANMANI	45	F	PRP	9 MONTHS	9	7	7	5	5
90	ARUN	54	M	CORTICOSTEROID	7 MONTHS	9	8	7	7	6
91	KARTHIK	45	M	CORTICOSTEROID	1.5 YEARS	9	6	5	4	4
92	VIMALA	35	F	CORTICOSTEROID	1 YEAR	9	7	6	6	5
93	THARUN	45	M	PRP	9 MONTHS	9	5	5	3	3
94	SHANTHI	46F	F	PRP	10 MONTHS	9	6	5	5	3

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
95	BALU	42	M	CORTICOSTEROID	11 MONTHS	9	6	4	4	4
96	KARPAGAM	35	F	CORTICOSTEROID	7 MONTHS	9	5	5	4	3
97	AROKIYAM	48	F	CORTICOSTEROID	9 MONTHS	9	6	6	5	3
98	KANNAN	40	M	PRP	8 MONTHS	9	6	5	2	2
99	RAJ	43	M	PRP	6 MONTHS	9	5	5	3	2
100	VINOTH	35	M	CORTICOSTEROID	7 MONTHS	8	6	5	5	4
101	PANDI	45	M	CORTICOSTEROID	9 MONTHS	9	7	7	4	4
102	RAVI	35	M	CORTICOSTEROID	11 MONTHS	9	8	6	5	3
103	MUTHU	54	M	PRP	8 MONTHS	9	7	5	3	3
104	DEVI	43	F	CORTICOSTEROID	9 MONTHS	9	8	7	6	4
105	MEENA	40	F	PRP	5 MONTHS	9	7	5	3	2
106	RADHIKA	35	F	CORTICOSTEROID	9 MONTHS	9	7	6	5	5
107	ARUMUGAM	34	M	CORTICOSTEROID	1 YEAR	9	8	7	5	4
108	KANDHAN	51	M	PRP	8 MONTHS	9	7	5	4	3
109	PRIYA	35	F	PRP	9 MONTHS	9	8	5	3	2
110	PRAVEENA	38	F	CORTICOSTEROID	10 MONTHS	9	7	7	4	3
111	SAMYKANNU	40	M	CORTICOSTEROID	1.5 YEARS	9	8	5	5	5
112	SONIYA	38	F	PRP	10 MONTHS	9	8	6	5	4
113	MURUGAN	50	M	PRP	6 MONTHS	9	8	4	3	2
114	MURALI	54	M	CORTICOSTEROID	8 MONTHS	9	8	5	5	5
115	MUTHUSAMY	47	M	CORTICOSTEROID	7 MONTHS	9	8	6	4	3
116	RAVICHANDRAN	45	M	CORTICOSTEROID	9 MONTHS	9	7	7	5	5
117	ARUNMOZHI	47	F	PRP	7 MONTHS	9	7	6	3	3

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
118	DEVA	35	M	PRP	6 MONTHS	9	8	6	5	3
119	RANI1	38	F	CORTICOSTEROID	8 MONTHS	9	8	6	5	5
120	KAMATCHI	40	F	CORTICOSTEROID	9 MONTHS	9	8	7	6	5
121	THENMOZHI	35	F	PRP	8 MONTHS	9	7	7	5	3
122	SHANKAR	46	M	PRP	10 MONTHS	9	7	6	3	2
123	BABU	43	M	PRP	6 MONTHS	9	8	6	3	1
124	TAMILSELVAN	50	M	CORTICOSTEROID	8 MONTHS	9	7	5	3	2
125	PRAVEEN	35	M	CORTICOSTEROIDS	7 MONTHS	9	8	6	3	2
126	LEELA	42	F	PRP	5 MONTHS	8	7	5	2	2
127	NARAYANAN	32	M	PRP	6 MONTHS	9	7	7	3	2
128	PREM	34	M	CORTICOSTEROIDS	4 MONTHS	9	7	7	5	3
129	KUMUTHA	56	F	PRP	8 MONTHS	9	7	6	3	1
130	JANA	35	M	PRP	5 MONTHS	9	8	5	2	1
131	SUDHARSAN	40	M	CORTICOSTEROIDS	8 MONTHS	9	8	6	4	4
132	VIGNESH	45	M	CORTICOSTEROIDS	7 MONTHS	9	8	5	3	3
133	DHIVYA	34	F	PRP	4 MONTHS	8	7	5	3	2
134	LAKSHMI	51	F	PRP	5 MONTHS	9	7	6	3	2
135	KAVITHA	43	F	CORTICOSTEROIDS	6 MONTHS	9	8	4	3	3
136	YUVRANI	30	F	CORTICOSTEROIDS	8 MONTHS	9	7	6	4	3
137	RAJAMMAL	48	F	PRP	5 MONTHS	8	6	5	3	1
138	GOUTHAM	45	M	PRP	6 MONTHS	9	7	6	4	2
139	MARIMUTHU	47	M	CORTICOSTEROIDS	9 MONTHS	9	8	6	5	5
140	ARAVINTH	56	M	CORTICOSTEROID	8 MONTHS	9	7	6	4	3

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
141	PRABHU	46	M	PRP	7 MONTHS	8	6	4	2	1
142	SUNDAR	34	M	CORTICOSTEROIDS	6 MONTHS	9	8	5	3	3
143	USHA	50	F	CORTICOSTEROIDS	5 MONTHS	9	8	6	4	3
144	RAMKUMAR	56	M	PRP	8 MONTHS	9	7	5	2	2
145	NAGARAJ	35	M	PRP	7 MONTHS	9	8	6	3	2
146	DEVAN	52	M	CORTICOSTEROIDS	8 MONTHS	9	7	6	5	5
147	VENKATESH	40	M	PRP	7 MONTHS	8	7	5	2	1
148	ISAIVANI	46	F	CORTICOSTEROIDS	6 MONTHS	9	8	6	4	4
149	AMUTHA	32	F	CORTICOSTEROIDS	5 MONTHS	9	7	5	4	3
150	EASAN	56	M	PRP	7 MONTHS	9	7	5	3	1
151	KUMARI	28	F	PRP	6 MONTHS	9	8	5	3	2
152	ANTONY	45	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	5	5
153	CHITRA	35	M	CORTICOSTEROIDS	8 MONTHS	9	7	5	4	4
154	JAMAL	43	M	CORTICOSTEROIDS	6 MONTHS	9	8	6	4	4
155	MALA	43	F	PRP	9 MONTHS	9	6	5	4	2
156	JEYANTHI	45	F	CORTICOSTEROIDS	6 MONTHS	9	7	5	5	5
157	PALANI	47	M	PRP	7 MONTHS	9	8	6	3	3
158	SASIREKHA	35	F	CORTICOSTEROIDS	5 MONTHS	9	7	5	5	4
159	NANDHAGOPAL	55	M	PRP	1 YEAR	9	7	6	3	2
160	RAMAR	40	M	PRP	9 MONTHS	9	8	5	3	2
161	SAMUNDESHWARI	36	F	CORTICOSTEROIDS	9 MPNTHS	9	7	5	4	4
162	SELVAM	33	M	PRP	6 MONTHS	9	8	6	3	1
163	AFROZ	47	M	CORTICOSTEROIDS	7 MONTHS	9	8	5	4	4

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
164	AMUL	46	F	PRP	9 MONTHS	9	8	7	3	2
165	AMUTHA	45	F	CORTICOSTEROIDS	7 MONTHS	9	6	6	4	4
166	BALAMURUGAN	36	M	PRP	6 MONTHS	8	6	6	6	4
167	BALU	29	M	CORTICOSTEROIDS	8 MONTHS	9	6	5	5	5
168	DEVI	36	F	CORTICOSTEROIDS	4 MONTHS	9	7	4	4	4
169	DHANALAKSHMI	44	F	CORTICOSTEROIDS	8 MONTHS	9	8	6	5	4
170	GANGA	37	F	PRP	7 MONTHS	9	7	5	3	2
171	GOVINDHAMMAL	41	F	PRP	8 MONTHS	9	7	5	4	2
172	IMMUNUVEL	45	M	PRP	9 MONTHS	9	8	6	5	3
173	JEEVA	43	M	CORTICOSTEROIDS	8 MONTHS	9	7	6	5	5
174	KALAIVANI	32	F	PRP	6 MONTHS	9	8	6	4	2
175	KALAVATHY	50	F	CORTICOSTEROIDS	5 MONTHS	8	7	5	4	4
176	KAMALA	40	F	PRP	9 MONTHS	9	7	6	4	2
177	KRISHNAVENI	35	F	PRP	5 MONTHS	9	7	5	3	1
178	MANJULA	38	F	CORTICOSTEROIDS	10 MONTHS	9	7	6	4	4
179	MARIKANNAN	44	M	CORTICOSTEROIDS	7 MONTHS	9	8	6	5	5
180	MEENA	38	F	CORTICOSTEROIDS	8 MONTHS	9	7	6	4	4
181	NAGAVALLI	39	F	PRP	6 MONTHS	9	8	7	4	2
182	PADMINI	29	F	PRP	7 MONTHS	9	8	6	5	2
183	PRAKASH	30	M	PRP	5 MONTHS	9	7	5	4	2
184	RAJ	38	M	CORTICOSTEROIDS	4 MONTHS	9	6	5	4	4
185	RAMALINGAM	43	M	CORTICOSTEROIDS	7 MONTHS	9	8	6	5	3
186	RANJANI	39	F	PRP	8 MONTHS	9	7	6	3	2

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
187	SAMUVEL	43	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	4	4
188	SARASWATHY	34	F	CORTICOSTEROIDS	4 MONTHS	9	7	6	5	4
189	SARAVANAN	45	M	PRP	7 MONTHS	9	8	6	3	2
190	SATHYA	37	F	PRP	9 MONTHS	9	7	6	3	2
191	SEETHALAKSHMI	41	F	CORTICOSTEROIDS	6 MONTHS	9	8	6	5	4
192	SETHURAMALINGAM	43	M	PRP	5 MONTHS	9	7	5	3	3
193	SHANTHI	36	F	PRP	8 MONTHS	9	8	6	4	3
194	SHARMILA	38	F	PRP	9 MONTHS	9	7	6	4	2
195	SHOBANA	30	F	CORTICOSTEROIDS	7 MONTHS	9	8	7	6	5
196	SUMATHY	29	F	CORTICOSTEROIDS	8 MONTHS	9	7	5	4	4
197	SURESHKUMAR	50	M	PRP	1 YEAR	9	7	5	3	2
198	VENKATESAN	38	M	CORTICOSTEROIDS	6 MONTHS	9	7	5	4	3
199	VENUGOPAL	36	M	CORTICOSTEROIDS	7 MONTHS	9	7	5	4	4
200	VIMALA	45	F	PRP	9 MONTHS	9	7	5	4	2
201	GOPI	33	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	5	5
202	EZHIL	49	M	PRP	10 MONTHS	9	7	4	3	2
203	DINESH	46	M	CORTICOSTEROIDS	9 MONTHS	9	6	5	4	4
204	GUNASEKAR	31	M	PRP	9 MONTHS	9	7	5	2	2
205	PAKKIYAM	48	F	CORTICOSTEROIDS	1 YEAR	9	7	6	5	5
206	SASIKALA	30	F	PRP	9 MONTHS	9	7	5	3	2
207	RAJU	43	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	4	4
208	ARAVINTH	37	M	PRP	10 MONTHS	9	7	5	3	2
209	HARISH	41	M	CORTICOSTEROIDS	9 MONTHS	9	7	5	4	4

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
21O	YUVARAJ	33	M	PRP	9 MONTHS	9	7	5	3	2
211	VINOTHINI	45	F	CORTICOSTEROIDS	10 MONTHS	9	6	5	3	3
212	SIVA	39	M	PRP	9 MONTHS	9	7	5	3	1
213	KANNIYAPPAN	43	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	4	4
214	JEGAN	28	M	PRP	9 MONTHS	9	7	5	3	2
215	MEGALA	41	F	CORTICOSTEROIDS	10 MONTHS	9	8	5	5	5
216	VINOTH	36	M	CORTICOSTEROIDS	1 YEAR	9	7	5	3	1
217	BALAN	38	M	CORTICOSTEROIDS	9 MONTHS	9	7	5	4	4
218	LATHA	42	F	CORTICOSTEROIDS	9 MONTHS	9	6	5	3	2
219	JAYABALAN	32	M	CORTICOSTEROIDS	9 MONTHS	9	7	5	5	5
220	JEYA	47	F	CORTICOSTEROIDS	9 MONTHS	9	7	5	3	2

SL NO 166 PATIENT WAS DIAGNOSED AS TUBERCULOUS SYNOVITIS.

MASTER CHART

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
1	VIJAYA	43	F	PRP	7 MONTHS	9	0	0	0	0
2	PALANI	40	M	CORTICOSTEROID	6 MONTHS	8	4	3	3	3
3	SUBASH	43	M	CORTICOSTEROID	4 MONTHS	9	8	8	8	8
4	SUSEELA	56	F	PRP	5 MONTHS	9	0	0	0	0
5	SELVI	37	F	PRP	6 MONTHS	8	2	0	0	0
6	SAKTHI	48	F	PRP	3 MONTHS	9	4	3	3	3
7	JANAKI	39	F	CORTICOSTEROID	1 YEAR	9	6	4	4	4
8	VALLI	55	F	PRP	3 MONTHS	9	0	0	0	0
9	BHARAT	38	M	PRP	5 MONTHS	8	8	8	8	8
10	RAMAN	38	M	PRP	1 YEAR	9	6	0	0	0
11	MARIYAN	48	M	CORTICOSTEROID	8 MONTHS	8	8	8	8	8
12	SUMAN	36	M	CORTICOSTEROID	1 ½ YEAR	8	6	2	0	0
13	GANESH	60	M	PRP	6 MONTHS	9	0	0	0	0
14	GOKUL	54	M	PRP	3 MONTHS	8	6	4	4	6
15	VIJI	55	M	CORTICOSTEROID	1 YEAR	9	0	0	0	0
16	SENBAGAM	36	F	CORTICOSTEROID	1 YEAR	9	2	0	2	8
17	SELVAM	49	M	PRP	1 YEAR	8	8	8	8	8
18	UMA	39	F	PRP	3 MONTHS	9	2	0	0	0
19	MAHESH	36	M	PRP	1 YEAR	8	8	8	8	8
20	PANDIYAN	38	M	CORTICOSTEROID	1 ½ YEAR	8	2	0	0	0
21	PADMINI	59	F	CORTICOSTEROID	8 MONTHS	9	1	0	0	0
22	RAJA	45	M	PPR	3 MONTHS	8	0	0	0	0
23	KALIYAN	55	M	CORTICOSTEROID	3 MONTHS	9	0	0	0	0
24	MANJU	28	F	CORTICOSTEROID	6 MONTHS	9	2	0	0	0

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
25	VENKAT	38	M	PRP	5 MONTHS	8	0	0	0	0
26	ANNIE	58	F	CORTICOSTEROID	1 YEARS	9	7	5	5	6
27	DHANAM	49	F	PRP	3 MONTHS	8	6	4	4	4
28	SENTHIL	31	M	CORTICOSTEROID	3 MONTHS	9	0	8	6	6
29	SAVITHA	49	F	PRP	1 ½ YEARS	8	3	0	0	0
30	RAVICHANDRAN	40	M	PRP	1 YEAR	8	6	3	3	3
31	THIRUPATHI	51	M	CORTICOSTEROID	8 MONTHS	8	6	4	4	4
32	GOVIND	50	M	CORTICOSTEROID	6 MONTHS	9	9	0	0	0
33	LALITHA	48	F	PRP	5 MONTHS	9	8	6	5	5
34	LAKSHMI	47	F	PRP	4 MONTHS	9	3	2	2	2
35	THANGAM	50	M	PRP	6 MONTHS	9	0	0	0	0
36	PARASURAMAN	49	M	CORTICOSTEROID	3 MONTHS	9	0	0	0	0
37	DARANI	27	M	PRP	8 MONTHS	9	8	6	4	2
38	MYTHILI	31	F	CORTICOSTEROID	6 MONTHS	9	0	0	0	2
39	SHANGAVI	46	F	CORTICOSTEROID	3 MONTHS	9	6	6	6	6
40	DEVAN	49	M	CORTICOSTEROID	4 MONTHS	9	2	1	0	0
41	NARAYAN	54	M	PRP	6 MONTHS	9	0	0	0	0
42	MOORTHY	69	M	PRP	8 MONTHS	9	0	0	0	0
43	PREM	49	M	PRP	1 YEAR	9	9	9	9	9
44	POOJA	48	F	CORTICOSTEROID	1 ½ YEARS	9	9	9	9	9
45	VENKATESAN	59	M	PRP	1 ½ YEARS	9	2	0	0	0
46	SARASU	30	F	PRP	8 MONTHS	8	6	4	4	4

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
47	RANIYAMMAL	48	F	CORTICOSTEROID	3 MONTHS	9	9	9	9	9
48	SIGARAM	39	M	CORTICOSTEROID	6 MONTHS	9	0	0	0	0
49	KAVI	34	M	PRP	8 MONTHS	8	4	1	1	1
50	RUKKU	43	F	CORTICOSTEROID	1 ½ YEARS	9	9	9	9	9
51	USHA	56	F	PRP	6 MONTHS	9	7	3	2	2
52	PADMA	54	F	PRP	1 ½ YEARS	9	7	7	7	7
53	SAVARIMUTHU	49	M	PRP	8 MONTHS	9	5	2	0	0
54	MARIAPPAN	63	M	PRP	5 MONTHS	8	3	0	0	0
55	MUTHU	54	M	CORTICOSTEROID	6 MONTHS	8	4	4	4	4
56	ANITHA	40	F	PRP	3 MONTHS	9	4	0	0	0
57	JAYAM	64	F	PRP	8 MONTHS	8	3	3	3	3
58	BHUVANESH	32	M	PRP	9 MONTHS	8	4	0	0	5
59	SAROJA	69	F	PRP	6 MONTHS	9	3	3	3	3
60	PARVEEN	40	M	CORTICOSTEROID	9 MONTHS	8	2	0	0	0
61	GOKUL	40	M	PRP	3 MONTHS	8	3	2	2	2
62	SUNDAR	30	M	CORTICOSTEROID	6 MONTHS	8	4	4	4	4
63	KALA	30	F	CORTICOSTEROID	5 MONTHS	9	7	3	3	3
64	MANOJ	40	M	PRP	8 MONTHS	8	2	2	2	2
65	PALANI	50	M	PRP	1 ½ YEARS	9	2	0	0	0
66	VIJAYA	50	F	CORTICOSTEROID	1 YEAR	8	4	0	0	0
67	KUTTI	60	F	PRP	2 YEARS	8	3	3	3	3
68	VIJAY	57	M	PRP	8 MONTHS	9	4	3	3	3

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
69	VARUN	40	M	PRP	9 MONTHS	9	7	3	2	2
70	SEELA	59	F	CORTICOSTEROID	3 MONTHS	9	3	3	3	3
71	RANI	45	F	PRP	7 MONTHS	9	5	5	3	3
72.	KANNAN	50	M	PRP	9 MONTHS	9	6	4	4	4
73	KARUPPAN	43	M	CORTICOSTEROID	9 MONTHS	9	5	3	3	3
74	ANITHA	32	F	CORTICOSTEROID	8 MONTHS	9	6	5	4	4
75	SUBA	34	F	CORTICOSTEROID	9 MONTHS	9	8	5	5	4
76	RAJA	42	M	PRP	6 MONTHS	8	6	4	2	2
77	KUMAR	33	M	CORTICOSTEROID	8 MONTHS	9	8	5	4	4
78	PRABHU	45	M	PRP	1 YEAR	9	6	3	2	2
79	SAKTHI	35	F	PRP	9 MONTHS	9	5	4	4	4
80	KUPPUSAMY	38	M	CORTICOSTEROID	8 MONTHS	9	7	5	4	4
81	RAJAN	56	M	CORTICOSTEROID	7 MONTHS	8	6	6	5	5
82	VIJAY	47	M	CORTICOSTEROID	8 MONTHS	9	6	5	4	4
83	DURAI	45	M	CORTICOSTEROID	10 MONTHS	9	6	4	4	3
84	KAVITHA	46	F	PRP	9 MONTHS	9	4	4	3	3
85	KAVIYA	55	F	PRP	9 MONTHS	9	6	3	3	2
86	KANNIYAMMAL	43	F	CORTICOSTEROID	8 MONTHS	9	7	6	6	6
87	ARPUTHAM	60	F	CORTICOSTEROID	6 MONTHS	8	6	6	5	4
88	TAMIL	43	F	PRP	7 MONTHS	9	6	4	3	3
89	KANMANI	45	F	PRP	9 MONTHS	9	7	7	5	5
90	ARUN	54	M	CORTICOSTEROID	7 MONTHS	9	8	7	7	6

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91	KARTHIK	45	M	CORTICOSTEROID	1.5 YEARS	9	6	5	4	4
92	VIMALA	35	F	CORTICOSTEROID	1 YEAR	9	7	6	6	5
93	THARUN	45	M	PRP	9 MONTHS	9	5	5	3	3
94	SHANTHI	46F	F	PRP	10 MONTHS	9	6	5	5	3
95	BALU	42	M	CORTICOSTEROID	11 MONTHS	9	6	4	4	4
96	KARPAGAM	35	F	CORTICOSTEROID	7 MONTHS	9	5	5	4	3
97	AROKIYAM	48	F	CORTICOSTEROID	9 MONTHS	9	6	6	5	3
98	KANNAN	40	M	PRP	8 MONTHS	9	6	5	2	2
99	RAJ	43	M	PRP	6 MONTHS	9	5	5	3	2
100	VINOTH	35	M	CORTICOSTEROID	7 MONTHS	8	6	5	5	4
101	PANDI	45	M	CORTICOSTEROID	9 MONTHS	9	7	7	4	4
102	RAVI	35	M	CORTICOSTEROID	11 MONTHS	9	8	6	5	3
103	MUTHU	54	M	PRP	8 MONTHS	9	7	5	3	3
104	DEVI	43	F	CORTICOSTEROID	9 MONTHS	9	8	7	6	4
105	MEENA	40	F	PRP	5 MONTHS	9	7	5	3	2
106	RADHIKA	35	F	CORTICOSTEROID	9 MONTHS	9	7	6	5	5
107	ARUMUGAM	34	M	CORTICOSTEROID	1 YEAR	9	8	7	5	4
108	KANDHAN	51	M	PRP	8 MONTHS	9	7	5	4	3
109	PRIYA	35	F	PRP	9 MONTHS	9	8	5	3	2
110	PRAVEENA	38	F	CORTICOSTEROID	10 MONTHS	9	7	7	4	3
111	SAMYKANNU	40	M	CORTICOSTEROID	1.5 YEARS	9	8	5	5	5
112	SONIYA	38	F	PRP	10 MONTHS	9	8	6	5	4

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
113	MURUGAN	50	M	PRP	6 MONTHS	9	8	4	3	2
114	MURALI	54	M	CORTICOSTEROID	8 MONTHS	9	8	5	5	5
115	MUTHUSAMY	47	M	CORTICOSTEROID	7 MONTHS	9	8	6	4	3
116	RAVICHANDRAN	45	M	CORTICOSTEROID	9 MONTHS	9	7	7	5	5
117	ARUNMOZHI	47	F	PRP	7 MONTHS	9	7	6	3	3
118	DEVA	35	M	PRP	6 MONTHS	9	8	6	5	3
119	RANI1	38	F	CORTICOSTEROID	8 MONTHS	9	8	6	5	5
120	KAMATCHI	40	F	CORTICOSTEROID	9 MONTHS	9	8	7	6	5
121	THENMOZHI	35	F	PRP	8 MONTHS	9	7	7	5	3
122	SHANKAR	46	M	PRP	10 MONTHS	9	7	6	3	2
123	BABU	43	M	PRP	6 MONTHS	9	8	6	3	1
124	TAMILSELVAN	50	M	CORTICOSTEROID	8 MONTHS	9	7	5	3	2
125	PRAVEEN	35	M	CORTICOSTEROIDS	7 MONTHS	9	8	6	3	2
126	LEELA	42	F	PRP	5 MONTHS	8	7	5	2	2
127	NARAYANAN	32	M	PRP	6 MONTHS	9	7	7	3	2
128	PREM	34	M	CORTICOSTEROIDS	4 MONTHS	9	7	7	5	3
129	KUMUTHA	56	F	PRP	8 MONTHS	9	7	6	3	1
130	JANA	35	M	PRP	5 MONTHS	9	8	5	2	1
131	SUDHARSAN	40	M	CORTICOSTEROIDS	8 MONTHS	9	8	6	4	4
132	VIGNESH	45	M	CORTICOSTEROIDS	7 MONTHS	9	8	5	3	3
133	DHIVYA	34	F	PRP	4 MONTHS	8	7	5	3	2
134	LAKSHMI	51	F	PRP	5 MONTHS	9	7	6	3	2

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
135	KAVITHA	43	F	CORTICOSTEROIDS	6 MONTHS	9	8	4	3	3
136	YUVRANI	30	F	CORTICOSTEROIDS	8 MONTHS	9	7	6	4	3
137	RAJAMMAL	48	F	PRP	5 MONTHS	8	6	5	3	1
138	GOUTHAM	45	M	PRP	6 MONTHS	9	7	6	4	2
139	MARIMUTHU	47	M	CORTICOSTEROIDS	9 MONTHS	9	8	6	5	5
140	ARAVINTH	56	M	CORTICOSTEROID	8 MONTHS	9	7	6	4	3
141	PRABHU	46	M	PRP	7 MONTHS	8	6	4	2	1
142	SUNDAR	34	M	CORTICOSTEROIDS	6 MONTHS	9	8	5	3	3
143	USHA	50	F	CORTICOSTEROIDS	5 MONTHS	9	8	6	4	3
144	RAMKUMAR	56	M	PRP	8 MONTHS	9	7	5	2	2
145	NAGARAJ	35	M	PRP	7 MONTHS	9	8	6	3	2
146	DEVAN	52	M	CORTICOSTEROIDS	8 MONTHS	9	7	6	5	5
147	VENKATESH	40	M	PRP	7 MONTHS	8	7	5	2	1
148	ISAIVANI	46	F	CORTICOSTEROIDS	6 MONTHS	9	8	6	4	4
149	AMUTHA	32	F	CORTICOSTEROIDS	5 MONTHS	9	7	5	4	3
150	EASAN	56	M	PRP	7 MONTHS	9	7	5	3	1
151	KUMARI	28	F	PRP	6 MONTHS	9	8	5	3	2
152	ANTONY	45	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	5	5
153	CHITRA	35	M	CORTICOSTEROIDS	8 MONTHS	9	7	5	4	4
154	JAMAL	43	M	CORTICOSTEROIDS	6 MONTHS	9	8	6	4	4
155	MALA	43	F	PRP	9 MONTHS	9	6	5	4	2
156	JEYANTHI	45	F	CORTICOSTEROIDS	6 MONTHS	9	7	5	5	5

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157	PALANI	47	M	PRP	7 MONTHS	9	8	6	3	3
158	SASIREKHA	35	F	CORTICOSTEROIDS	5 MONTHS	9	7	5	5	4
159	NANDHAGOPAL	55	M	PRP	1 YEAR	9	7	6	3	2
160	RAMAR	40	M	PRP	9 MONTHS	9	8	5	3	2
161	SAMUNDESHWARI	36	F	CORTICOSTEROIDS	9 MPNTHS	9	7	5	4	4
162	SELVAM	33	M	PRP	6 MONTHS	9	8	6	3	1
163	AFROZ	47	M	CORTICOSTEROIDS	7 MONTHS	9	8	5	4	4
164	AMUL	46	F	PRP	9 MONTHS	9	8	7	3	2
165	AMUTHA	45	F	CORTICOSTEROIDS	7 MONTHS	9	6	6	4	4
166	BALAMURUGAN	36	M	PRP	6 MONTHS	8	6	6	6	4
167	BALU	29	M	CORTICOSTEROIDS	8 MONTHS	9	6	5	5	5
168	DEVI	36	F	CORTICOSTEROIDS	4 MONTHS	9	7	4	4	4
169	DHANALAKSHMI	44	F	CORTICOSTEROIDS	8 MONTHS	9	8	6	5	4
170	GANGA	37	F	PRP	7 MONTHS	9	7	5	3	2
171	GOVINDHAMMAL	41	F	PRP	8 MONTHS	9	7	5	4	2
172	IMMUNUVEL	45	M	PRP	9 MONTHS	9	8	6	5	3
173	JEEVA	43	M	CORTICOSTEROIDS	8 MONTHS	9	7	6	5	5
174	KALAIVANI	32	F	PRP	6 MONTHS	9	8	6	4	2
175	KALAVATHY	50	F	CORTICOSTEROIDS	5 MONTHS	8	7	5	4	4
176	KAMALA	40	F	PRP	9 MONTHS	9	7	6	4	2
177	KRISHNAVENI	35	F	PRP	5 MONTHS	9	7	5	3	1
178	MANJULA	38	F	CORTICOSTEROIDS	10 MONTHS	9	7	6	4	4

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
179	MARIKANNAN	44	M	CORTICOSTEROIDS	7 MONTHS	9	8	6	5	5
180	MEENA	38	F	CORTICOSTEROIDS	8 MONTHS	9	7	6	4	4
181	NAGAVALLI	39	F	PRP	6 MONTHS	9	8	7	4	2
182	PADMINI	29	F	PRP	7 MONTHS	9	8	6	5	2
183	PRAKASH	30	M	PRP	5 MONTHS	9	7	5	4	2
184	RAJ	38	M	CORTICOSTEROIDS	4 MONTHS	9	6	5	4	4
185	RAMALINGAM	43	M	CORTICOSTEROIDS	7 MONTHS	9	8	6	5	3
186	RANJANI	39	F	PRP	8 MONTHS	9	7	6	3	2
187	SAMUVEL	43	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	4	4
188	SARASWATHY	34	F	CORTICOSTEROIDS	4 MONTHS	9	7	6	5	4
189	SARAVANAN	45	M	PRP	7 MONTHS	9	8	6	3	2
190	SATHYA	37	F	PRP	9 MONTHS	9	7	6	3	2
191	SEETHALAKSHMI	41	F	CORTICOSTEROIDS	6 MONTHS	9	8	6	5	4
192	SETHURAMALINGAM	43	M	PRP	5 MONTHS	9	7	5	3	3
193	SHANTHI	36	F	PRP	8 MONTHS	9	8	6	4	3
194	SHARMILA	38	F	PRP	9 MONTHS	9	7	6	4	2
195	SHOBANA	30	F	CORTICOSTEROIDS	7 MONTHS	9	8	7	6	5
196	SUMATHY	29	F	CORTICOSTEROIDS	8 MONTHS	9	7	5	4	4
197	SURESHKUMAR	50	M	PRP	1 YEAR	9	7	5	3	2
198	VENKATESAN	38	M	CORTICOSTEROIDS	6 MONTHS	9	7	5	4	3
199	VENUGOPAL	36	M	CORTICOSTEROIDS	7 MONTHS	9	7	5	4	4
200	VIMALA	45	F	PRP	9 MONTHS	9	7	5	4	2

SL NO	NAME	AGE	SEX	TYPE OF INJECTION	DURATION OF PAIN	PAIN SCORE AT TIME OF INJECTION	PAIN SCORE AT 1ST MONTH	PAIN SCORE AT 2ND MONTH	PAIN SCORE AT 4TH MONTH	PAIN SCORE AT 6TH MONTH
201	GOPI	33	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	5	5
202	EZHIL	49	M	PRP	10 MONTHS	9	7	4	3	2
203	DINESH	46	M	CORTICOSTEROIDS	9 MONTHS	9	6	5	4	4
204	GUNASEKAR	31	M	PRP	9 MONTHS	9	7	5	2	2
205	PAKKIYAM	48	F	CORTICOSTEROIDS	1 YEAR	9	7	6	5	5
206	SASIKALA	30	F	PRP	9 MONTHS	9	7	5	3	2
207	RAJU	43	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	4	4
208	ARAVINTH	37	M	PRP	10 MONTHS	9	7	5	3	2
209	HARISH	41	M	CORTICOSTEROIDS	9 MONTHS	9	7	5	4	4
21O	YUVARAJ	33	M	PRP	9 MONTHS	9	7	5	3	2
211	VINOTHINI	45	F	CORTICOSTEROIDS	10 MONTHS	9	6	5	3	3
212	SIVA	39	M	PRP	9 MONTHS	9	7	5	3	1
213	KANNIYAPPAN	43	M	CORTICOSTEROIDS	9 MONTHS	9	7	6	4	4
214	JEGAN	28	M	PRP	9 MONTHS	9	7	5	3	2
215	MEGALA	41	F	CORTICOSTEROIDS	10 MONTHS	9	8	5	5	5
216	VINOTH	36	M	CORTICOSTEROIDS	1 YEAR	9	7	5	3	1
217	BALAN	38	M	CORTICOSTEROIDS	9 MONTHS	9	7	5	4	4
218	LATHA	42	F	CORTICOSTEROIDS	9 MONTHS	9	6	5	3	2
219	JAYABALAN	32	M	CORTICOSTEROIDS	9 MONTHS	9	7	5	5	5
220	JEYA	47	F	CORTICOSTEROIDS	9 MONTHS	9	7	5	3	2

SL NO 166 PATIENT WAS DIAGNOSED AS TUBERCULOUS SYNOVITIS.